Vol. III AUGUST, 1918 No. 11

The Journal of Laboratory and Clinical Medicine

VICTOR C. VAUGHAN, M.D., Editor-in-Chief
University of Michigan, Ann Arbor

ASSOCIATE EDITORS

Pharmacology
DENNIS E. JACKSON, M.D.
Washington University, St. Louis

Bacteriology
HANS ZINSSER, M.D.
Columbia University, New York

Immunology and Serology
FREDERICK P. GAY, M.D.
University of California, Berkeley

Physiological Pathology
PAUL G. WOOLLEY, M.D.
University of Cincinnati, Cincinnati

Physiological Chemistry and Clinical Physiology
J. J. R. MACLEOD, M.B.
University of Toronto, Toronto

ROY G. PEARCE, M.D.
Lakeside Hospital, Cleveland

Clinical Microscopy and Laboratory Technic
ROGER S. MORRIS, M.D.
University of Cincinnati, Cincinnati

Neuropathology
E. E. SOUTHARD, M.D.
Harvard University, Boston

Tuberculosis
GERALD B. WEBB, M.D.
Cragmor Sanatorium, Colorado Springs

Published by
THE C. V. MOSBY COMPANY
ST. LOUIS

$3.00 Per Annum Single Copies, 30 Cents

Apothesine

A Remarkable Local Anesthetic

APOTHESINE is more potent than most products in its field. At the same time it is less toxic than many of them. Not being a derivative of cocaine, it is free from habit-forming characteristics and is not subject to State or Federal narcotic law.

APOTHESINE is applicable in any procedure in which a local anesthetic is indicated. It has been used in every imaginable minor surgical operation, and in such more formidable operations as that for umbilical hernia, in major abdominal operations, excision of carcinoma, the thyroid and cysts, removal of gall-stones, prostatectomy, laparotomy for extra-uterine pregnancy, and others of equal importance.

APOTHESINE, in solution, may be sterilized by heating to the boiling point. It may be combined with any of the usual synergists.

SUPPLIED AS HYPODERMIC TABLETS.

H. T. No. 216.—Each tablet contains 1½ grains of Apothesine. One tablet in 60 minims of water makes a 2% solution. Tubes of 20 and bottles of 100.

H. T. No. 217.—Each tablet contains 3/5 grain of Apothesine and 1/1600 grain of Adrenalin. One tablet in 60 minims of water makes a 1% solution of Apothesine in Adrenalin 1:100,000. Tubes of 25 and bottles of 100.

H. T. No. 218 (Dental).—Each tablet contains ½ grain of Apothesine and 1/2500 grain of Adrenalin. One tablet in 16 minims of water makes a 2% solution of Apothesine in Adrenalin 1:40,000. Tubes of 20 and bottles of 100.

Compare Apothesine with any other local anesthetic.
We invite the test.

PARKE, DAVIS & CO.

Laboratories: Detroit, Mich., U. S. A.; Walkerville, Ont.; Hounslow, Eng.

Branch Houses and Depots: New York, Chicago, Kansas City, St. Louis, Baltimore, New Orleans, Minneapolis, Seattle, Buffalo, Pittsburgh, Cincinnati, Indianapolis, U. S. A.; Montreal, Que.; London, Eng.; Sydney, N. S. W.; Petrograd, Russia; Bombay, India; Tokio, Japan; Buenos Aires, Argentina; Havana, Cuba.

The Journal of Laboratory and Clinical Medicine

VOL. III. ST. LOUIS, AUGUST, 1918 No. 11

ORIGINAL ARTICLES

COMMUNICABLE DISEASES IN THE NATIONAL GUARD AND NATIONAL ARMY OF THE UNITED STATES DURING THE SIX MONTHS FROM SEPTEMBER 29, 1917, TO MARCH 29, 1918*

BY COL. VICTOR C. VAUGHAN, M.C., N.A., AND CAPT. GEORGE T. PALMER, S.C. N.A., WASHINGTON, D. C.

PREFACE

THE authors would call attention to the fact that this report has been prepared with the object of giving publicity during the present year to the salient features of communicable disease incidence in the United States Army during the past winter. The statistical data have been drawn from the telegraphic reports sent in weekly from each camp, cantonment and army post or station. These reports are altered somewhat later on due to change of diagnosis or some other cause and the results here given may not agree in every detail with the more permanent and complete personal histories sent in to the Sick and Wounded Division each month. Delay in reporting makes the latter data unavailable for current use.

INTRODUCTION

The purpose of this report is to take stock of health matters in our armies, to study the data furnished in weekly telegraphic reports, to review the records of sanitary inspectors and epidemiologists, to ascertain what diseases have appeared in the armies and the extent of their spread, and to investigate the avenues through which these infections have found their way into the camps. The mobilization of raw, untrained men and their hurried transformation into

*A Report from the Section of Communicable Diseases, Division of Sanitation, prepared under the direction of Colonel Deane C. Howard, and Published by Permission of the Surgeon General.

effective soldiers, has always been accompanied by marked increase in morbidity and mortality. The assembly of young men in camps acts like a dragnet bringing to a central point all infections prevalent in the area from which these men came. The wider the area, the larger the numbers of those brought together, the greater the susceptibility of the individuals constituting the assembly, the more closely these individuals are crowded together and the more intimate their contact, the larger the number of bearers of the infections, the more virulent the disease-causing organisms brought into the camps, the greater will be the morbidity and mortality from communicable diseases. Our government has assembled within less than one year more than one million untrained, undisciplined men, the most of whom were quite ignorant of personal hygiene and without previous experience in caring for themselves under conditions of army life. That the morbidity and mortality from communicable diseases among these should show an average above the figures shown in the civilian life from which they came, was to be expected by one familiar with the science of epidemiology.

We have chosen to cover the time from September 29, 1917, to March 29, 1918, because the camps were fairly well developed on the first of these dates and the period covers the winter months and our findings can be compared with the summer months when there will be felt the seasonal influence on the character and spread of infections. Furthermore, lessons learned from these studies may give information which possibly may be utilized with great advantage next winter.

This report covers and is confined to the time period mentioned and any conclusions that are drawn may be considered tentative and founded upon the evidence so far secured and subject to such modification as may be justified by additional information.

The data that follow deal for the most part with thirteen National Guard Camps and sixteen National Army Cantonments, which represent over 70 per cent of the troops in this country during the period in question. Records from small and scattered units and from the various posts of the Regular Army are omitted, as the data from these places are less readily subjected to statistical analysis. All of these facts will, of course, be included in later reports. The data from four large guard camps which were in existence in October are omitted because the men were shifted elsewhere shortly afterward. The present report deals with camps which were in existence continuously throughout the six months.

COMPARATIVE MORTALITY IN ARMY AND CIVIL LIFE

In studying this phase of our problem there are several facts which must be considered. Some of the more important of these are as follows:

The death rate in the Army should be compared with that for the same age period in civil life. The comparison should be made on the records for the same time of the year and so far as possible for the same year. Through the courtesy of the health and vital statistics departments of certain cities we are able to do this. The greater number of enlisted men in the army are between 21 and 31 years of age. The period nearest this available in civil statistics is

the age from 20 to 29 years. In all comparisons between military and civilian death rates the following should be borne in mind:

(1) The death rate of the group 20 to 29 years is lower than that of the present draft age 21 to 31 years.

(2) The death rate in these age groups is greater among males than among females.

(3) The army includes more above than below the draft age. In all these respects a comparison is slightly to the disadvantage of the army.

The figures for this comparison are expressed as annual rates calculated on actual deaths occurring during the period.

TABLE 1

ANNUAL DEATH RATE PER 1000

(Age 20 to 29 Years, Time, Oct., Nov., Dec., 1917; Jan., Feb., Mar., 1918.)

PLACE	DEATH RATE
Army	9.1
New York City	5.5
Saint Louis	5.5
New Orleans	10.4
Pittsburg	6.2
Chicago	5.2

To obtain this information, requests were sent the Commissioners of Health of all states and a number of cities within the Registration Area. It is on the replies received that the civil statistics of the past winter are based. There are instances of wide variation in the rates of certain diseases. The accuracy of some of these may be questioned. Errors may have been caused by improper reporting or else by erroneous population figures used in the computation of rates. Populations have been estimated in the customary manner followed by the Census Bureau which assumes increases in arithmetical progression. This is open to error because the present is the eighth year since the last census of 1910, and we do not know that populations in all cases have increased in this manner.

It is seen from these figures that the average death rate for the whole army is higher than that of any city in the list with the exception of New Orleans.

The distribution of death rates by age groups in the Registration Area of the United States during the winter months of 1915, is shown by the census of that year in Table 2, in comparison with the army rate during corresponding months of 1917-1918.

TABLE 2

PLACE	DEATH RATE PER 1000
Army	9.1
U. S. Registration Area:	
All ages	14.3
Age 20 to 49	8.3
Age 20 to 39	6.8
Age 20 to 29	5.7

The Registration Area in 1915 included 25 states, the District of Columbia, and 41 cities in non-registration states. Included among the registration states is North Carolina, the returns from which relate only to municipalities having 1000 or more inhabitants in 1910. The states and cities making up this area are those for which the registration of deaths has been accepted as being approximately complete (at least 90 per cent of all deaths being registered) and which were admitted to the Registration Area only after it was known from the data at hand that the deaths were being recorded properly under State law or for cities, under municipal ordinance.

These figures show that while the older age groups have the higher rates, all below 49 are lower than the Army. It must be borne in mind, however, that the Registration Area covers a wide diversity in density of population, while the closeness of contact in the camps is greater and more continuous than that

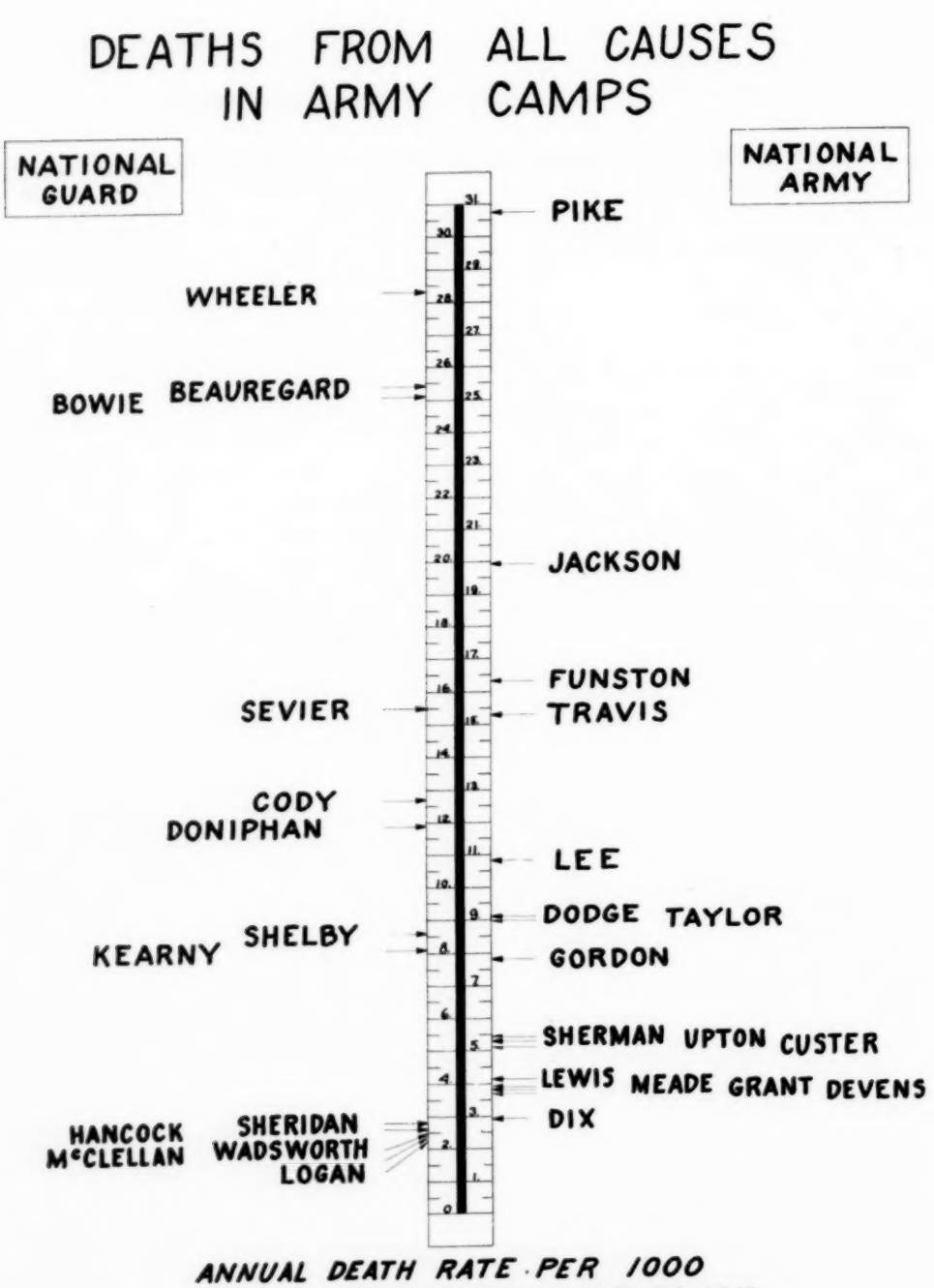

DEATHS FROM ALL CAUSES
IN ARMY CAMPS
NATIONAL GUARD
NATIONAL ARMY
PIKE
WHEELER
BOWIE
BEAUREGARD
JACKSON
FUNSTON
SEVIER
TRAVIS
CODY
DONIPHAN
LEE
DODGE
TAYLOR
KEARNY
SHELBY
GORDON
SHERMAN
UPTON
CUSTER
LEWIS
MEADE
GRANT
DEVENS
DIX
HANCOCK
McCLELLAN
SHERIDAN
WADSWORTH
LOGAN
ANNUAL DEATH RATE PER 1000
SEPT. 29, 1917 TO MAR. 29, 1918

Chart I.

of the most crowded city. Furthermore, the Registration Area does not include the States of South Carolina, Georgia, Florida, Tennessee, Alabama, Mississippi, Louisiana, Oklahoma and Texas, where death rates are higher. As will be seen in Table 3, which gives the rates for each camp, there are 13 camps out of 29 with rates below the rate for age group 20 to 29 in the Registration Area. It may be pointed out also that while some deaths may escape report in civil life, all in the camps are reported.

It is a striking fact that the death rates in the different camps show wide variation as is indicated in Table 3.

TABLE 3
(See Chart 1)
ANNUAL DEATH RATE PER 1000

NATIONAL GUARD		NATIONAL ARMY	
Wheeler	28.3	Pike	30.7
Beauregard	25.4	Jackson	19.9
Bowie	23.1	Funston	16.3
Sevier	15.5	Travis	15.3
Cody	12.7	Lee	10.8
Doniphan	11.9	Dodge	9.1
Shelby	8.6	Taylor	9.0
Kearny	8.1	Gordon	7.8
Sheridan	2.8	Sherman	5.4
Hancock	2.6	Upton	5.3
Wadsworth	2.5	Custer	5.1
McClellan	2.4	Lewis	4.1
Logan	2.3	Meade	3.9
		Grant	3.8
		Devens	3.7
		Dix	2.9

It will be seen by comparing Table 3 with Table 1 that five National Guard camps (Sheridan, Hancock, Wadsworth, McClellan and Logan) have shown lower death rates than New York City, St. Louis, New Orleans, Pittsburg and Chicago for the age group 20 to 29 years. Two more National Guard camps (Shelby and Kearney) show lower death rates than New Orleans for this age group. Six National Army camps (Custer, Lewis, Meade, Grant, Devens and Dix) show lower death rates than any of the above mentioned cities. Two other National Army camps (Sherman and Upton) are about on a level with New York, St. Louis and Chicago, and below Pittsburgh and New Orleans. Three more National Army camps (Dodge, Taylor and Gordon) are below New Orleans. These facts demonstrate that camp life may be made as safe as that of some of our best health-guarded cities, and indeed may show a lower death rate in the corresponding age group. It is worthy of note that Camps Wadsworth and Upton, both made up largely of New York troops, compare favorably with New York City; that Hancock, composed of the Pennsylvania National Guard, is better than Pittsburgh; that Logan, occupied by the National Guard of Illinois, is better than Chicago; that Doniphan, occupied by the Missouri National Guard, is worse than St. Louis; and that Beauregard, the location of the National Guards of Louisiana, Mississippi and Arkansas, is far worse than New Orleans. Chart II is presented to show comparative death rates in civil life and National Guard and National Army Camps.

In Table 4 are given the site of the camps and States which furnished troops to each camp.

The question of the wide variations in the death rates in the different camps is a difficult one to answer. There are evidently many factors involved, some of which will be briefly discussed.

(1) Some of the camps have acted as filters through which many troops have passed, leaving their most unfit on the filter. To figure the average strength of these camps as a basis for the computation of their death rate is hardly fair, but we know of no other way to do this. It is a striking thing that the worst camps as measured by their death rates are bad when measured by sick admissions, noneffective rate, and prevalence of each of the most important communicable diseases, including venereal disease, the last of which certainly is not

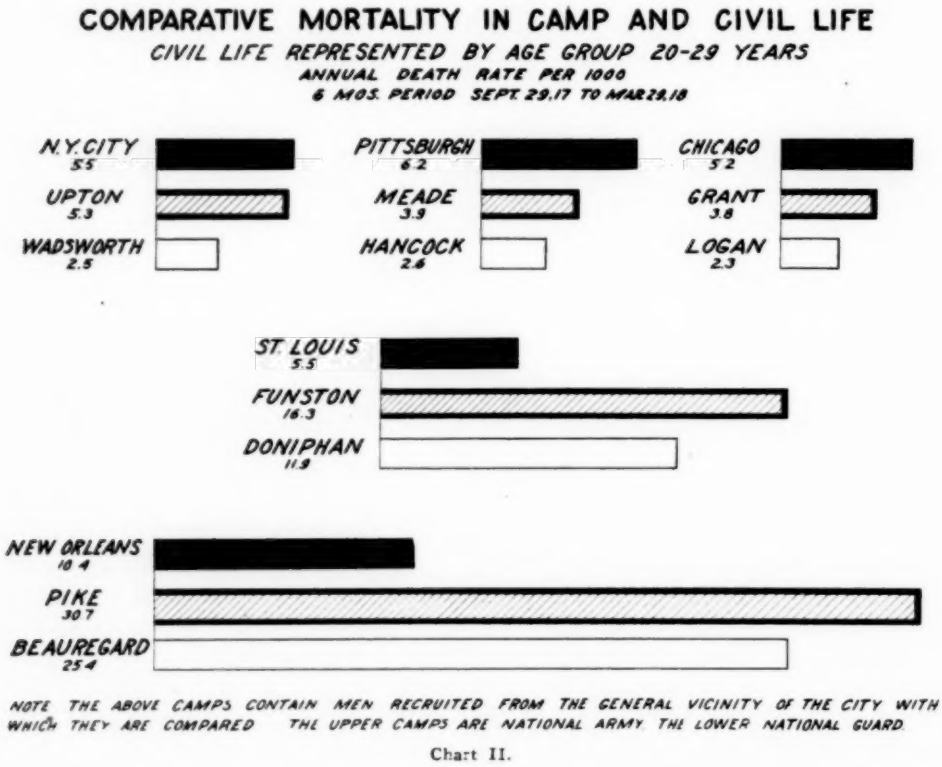

COMPARATIVE MORTALITY IN CAMP AND CIVIL LIFE
CIVIL LIFE REPRESENTED BY AGE GROUP 20-29 YEARS
ANNUAL DEATH RATE PER 1000
6 MOS. PERIOD SEPT. 29,17 TO MAR 29,18
N.Y. CITY 5.5
UPTON 5.3
WADSWORTH 2.5
PITTSBURGH 6.2
MEADE 3.9
HANCOCK 2.6
CHICAGO 5.2
GRANT 3.8
LOGAN 2.3
ST. LOUIS 5.5
FUNSTON 16.3
DONIPHAN 11.9
NEW ORLEANS 10.4
PIKE 30.7
BEAUREGARD 25.4
NOTE THE ABOVE CAMPS CONTAIN MEN RECRUITED FROM THE GENERAL VICINITY OF THE CITY WITH WHICH THEY ARE COMPARED THE UPPER CAMPS ARE NATIONAL ARMY THE LOWER NATIONAL GUARD

Chart II.

influenced by weather, housing, clothing, camp sanitation, medical or health supervision of the camp. This is graphically shown by Chart III. In a general way it can be stated that those camps which may be designated as closed camps and which have been least employed as filters are the healthiest camps. However, there are exceptions to this.

These filter camps may suffer so far as morbidity and mortality rates are concerned in two ways. First, the camps from which troops have come may have selected the least desirable men for transfer. There are reasons for suspecting that this has been done. In this way the filter camp suffers on account of the inferiority of the material received. In the second place when the troops pass on to another camp many of the unfit may be left behind. Funston and Pike have been notable filter camps as thus explained.

Wadsworth may be taken as an example of a closed camp. Practically no

TABLE 4

LOCATION OF NATIONAL GUARD AND NATIONAL ARMY CAMPS, TOGETHER WITH THE STATES FROM WHICH MEN ARE DRAWN

OCTOBER, 1917, TO MARCH, 1918

NATIONAL GUARD

CAMP	SITE	SOURCE OF TROOPS
Beauregard	Alexandria, La.	Arkansas, Louisiana, Mississippi
Bowie	Ft. Worth, Tex.	Oklahoma, Texas
Cody	Deming, N. M.	Iowa, Minnesota, Nebraska, South Dakota
Doniphan	Ft. Sill, Okla.	Kansas, Missouri
Hancock	Augusta, Ga.	Pennsylvania
Kearny	Linda Vista, Cal.	Arizona, California, Colorado, New Mexico, Utah
Logan	Houston, Tex.	Illinois
McClellan	Anniston, Ala.	Delaware, District of Columbia, Maryland, New Jersey, Virginia
Sevier	Greenville, S. C.	North Carolina, South Carolina, Tennessee
Shelby	Hattiesburg, Miss.	Indiana, Kentucky, West Virginia
Sheridan	Montgomery, Ala.	Ohio
Wadsworth	Spartanburg, S. C.	New York
Wheeler	Macon, Ga.	Alabama, Florida, Georgia

NATIONAL ARMY

Custer	Battle Creek, Mich.	Michigan, Wisconsin
Devens	Ayer, Mass.	Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York
Dix	Wrightstown, N. J.	Delaware, New Jersey, New York
Dodge	Des Moines, Iowa	Illinois, Iowa, Minnesota, North Dakota
Funston	Ft. Riley, Kan.	Arizona, Colorado, Kansas, Missouri, Nebraska, New Mexico, South Dakota
*Gordon	Atlanta, Ga.	Alabama, Georgia, Tennessee
Grant	Rockford, Ill.	Illinois, Wisconsin
Jackson	Columbia, S. C.	Florida, North Carolina, South Carolina
Lee	Petersburg, Va.	Pennsylvania, Virginia, West Virginia
Lewis	American Lake, Wash.	Alaska, California, Idaho, Montana, Nevada, Oregon, Utah, Washington, Wyoming
Meade,	Annapolis Junction, Md.	District of Columbia, Maryland, Pennsylvania
Pike	Little Rock, Ark.	Alabama, Arkansas, Louisiana, Mississippi
Sherman	Chillicothe, Ohio	Ohio
Taylor	Louisville, Ky.	Illinois, Indiana, Kentucky
Travis	Ft. Sam Houston, Tex.	Oklahoma, Texas
Upton	Yaphank, L. I., N. Y.	New York

NOTE: The States indicated represent the chief source of troops at each place. There are small increments from other points in a number of camps.

*This camp was occupied by the troops indicated less than two months, when these troops were sent to Wheeler and replaced at Gordon by draft men from many states.

new troops reached this camp during the period covered by this report. In fact the first accessions came in March and consisted of 1500 select men from Camp Taylor. These men had been in service but a short time and were from the mountains of Kentucky and Tennessee. They came with and continued to develop pneumonia, meningitis and minor diseases and soon had a noneffective rate of 79 per 1000 as compared with 24 for the 27th Division. Before this accession the 27th Division consisted wholly of the New York National Guard and the men came from the larger cities of that State with but few from rural communities.

It is a frequent observation in the reports of the health of organizations that all accessions of unseasoned men are followed by a rise in the morbidity curve of "all diseases," and especially of the acute respiratory diseases.* On

*Throughout this paper we use the words "respiratory diseases," in referring to those diseases transmitted through the respiratory organs.

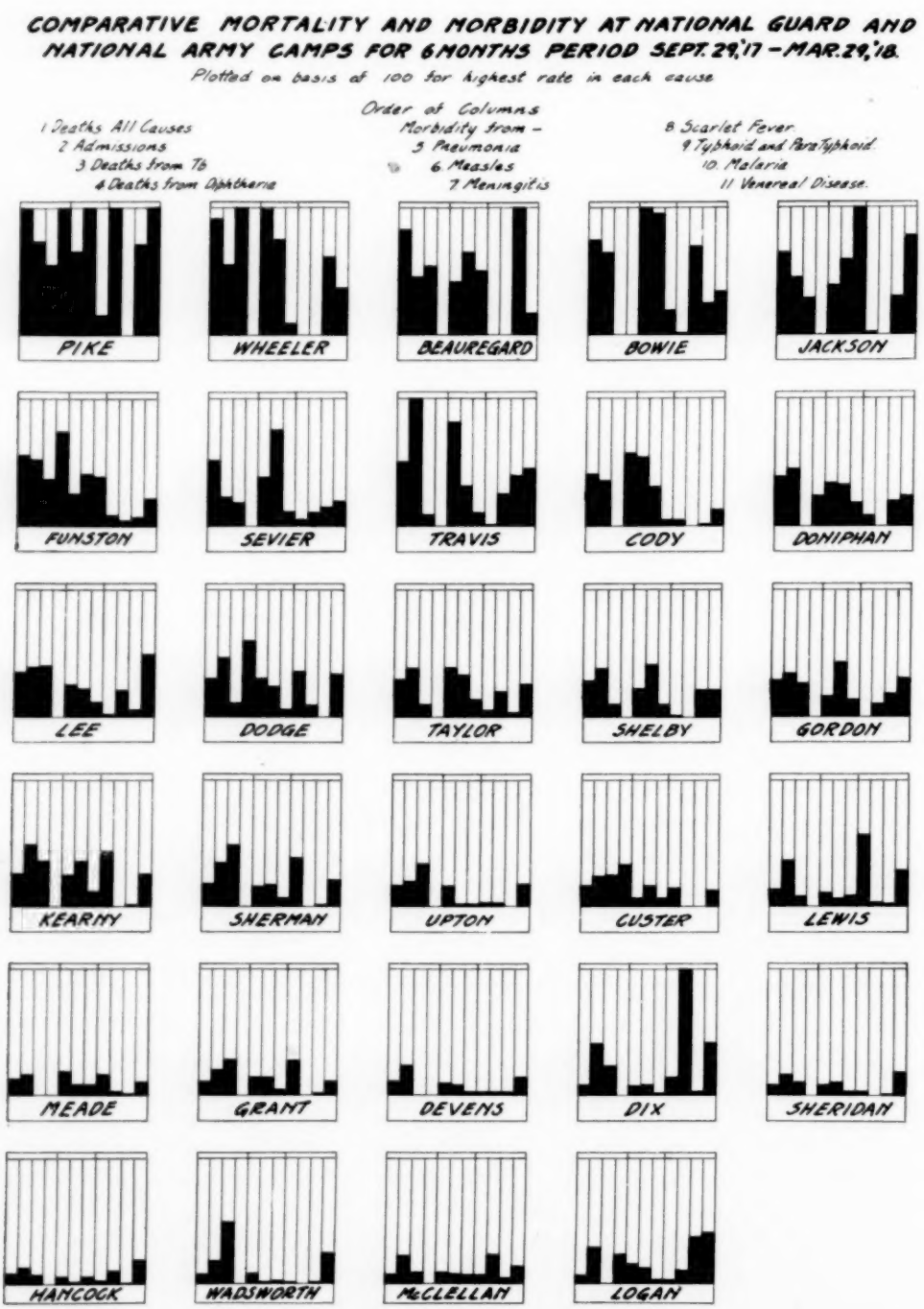

COMPARATIVE MORTALITY AND MORBIDITY AT NATIONAL GUARD AND NATIONAL ARMY CAMPS FOR 6 MONTHS PERIOD SEPT. 29, '17 – MAR. 29, '18.
Plotted on basis of 100 for highest rate in each cause
1 Deaths All Causes
2 Admissions
3 Deaths from TB
4 Deaths from Diphtheria
Order of Columns
Morbidity from –
5 Pneumonia
6 Measles
7 Meningitis
8 Scarlet Fever
9 Typhoid and Para Typhoid
10 Malaria
11 Venereal Disease.
PIKE
WHEELER
BEAUREGARD
BOWIE
JACKSON
FUNSTON
SEVIER
TRAVIS
CODY
DONIPHAN
LEE
DODGE
TAYLOR
SHELBY
GORDON
KEARNY
SHERMAN
UPTON
CUSTER
LEWIS
MEADE
GRANT
DEVENS
DIX
SHERIDAN
HANCOCK
WADSWORTH
McCLELLAN
LOGAN

Chart III.

the other hand it seems true that variations in the morbidity curve are less apparent in the more stable organizations. Furthermore, it is frequently stated that the type of an existing disease changes simultaneously with the accession. Lobar pneumonia was the prevalent form of this disease at Grant until troops from Jefferson Barracks arrived, after which bronchopneumonia with streptococcus infection became the predominant type. Fatigue from a long journey by rail may have some effect in lowering resistance, though possibly overcrowding in trains may be a greater factor.

(2) We have tried to ascertain the influence of race, nationality, section of the country from which the troops have come and other similar circumstances on the morbidity and mortality of the several camps, but the data that we have obtained on these points do not justify us in speaking other than tentatively concerning these matters. However, the following points seem to be fairly clear. Under similar conditions the negro is more susceptible to the acute respiratory diseases than the northern white man. The death rate from pneumonia among the negro troops at camp Dodge has been to that from the same disease among the whites as 4.4 is to 1. It will be interesting to note whether this holds true during the warmer months. Southern whites are more susceptible to this disease than are northern whites. These observations are in accord with those of other observers both in this country and abroad. The elder Flint, who practiced medicine both in the North and in the South, made statements to this effect many years ago. The French have found their African troops especially susceptible to pneumonia and have been compelled to provide warmer quarters and heavier clothing for them in the winter than are necessary for the native French soldier. General Gorgas had abundant opportunity to study pneumonia on the Canal Zone and in South Africa, and before the assembly of our troops began he predicted that the acute respiratory diseases and especially pneumonia would be among the most prevalent diseases.

It is an opinion generally held by medical officers in southern camps that hookworm disease and chronic malarial infection increase susceptibility to the acute respiratory diseases. The information we have on these points is not as full as desirable. There has been a careful examination of the feces of the 36th Division at Bowie, with the following results:

Total strength	25,224
Number examined	23,659
Positive hookwormm	2,921=12.3%
Tapeworm	480= 2 %
Miscellaneous parasites	24

(3) There is no reason for believing that either morbidity or mortality in any camp has been due to faulty sanitation, as we usually understand this term. All the camps are kept clean, have unquestioned water supplies, satisfactory garbage and sewage removal, etc.

The unsanitary camp of 1898, as seen as Chickamauga, and in other encampments of that time, does not exist in the United States today. There undoubtedly has been some faulty handling of the communicable diseases. In certain camps sick men have been allowed to remain in quarters too long for their own good and for the protection of their comrades from infection. There have been mistakes in diagnosis which have favored the spread of infection. In

some camps there has been no attempt to distinguish between the two diseases known under the name of measles and these have been mingled in the hospitals with the result that the patient has had both diseases before he was through. The differential diagnosis between measles and scarlet fever has not always been correct and there has been some mixing of patients in wards devoted to these diseases. Such mistakes occur in private practice, probably with greater frequency, but the consequences are not so serious as they are in the large and crowded army hospitals.

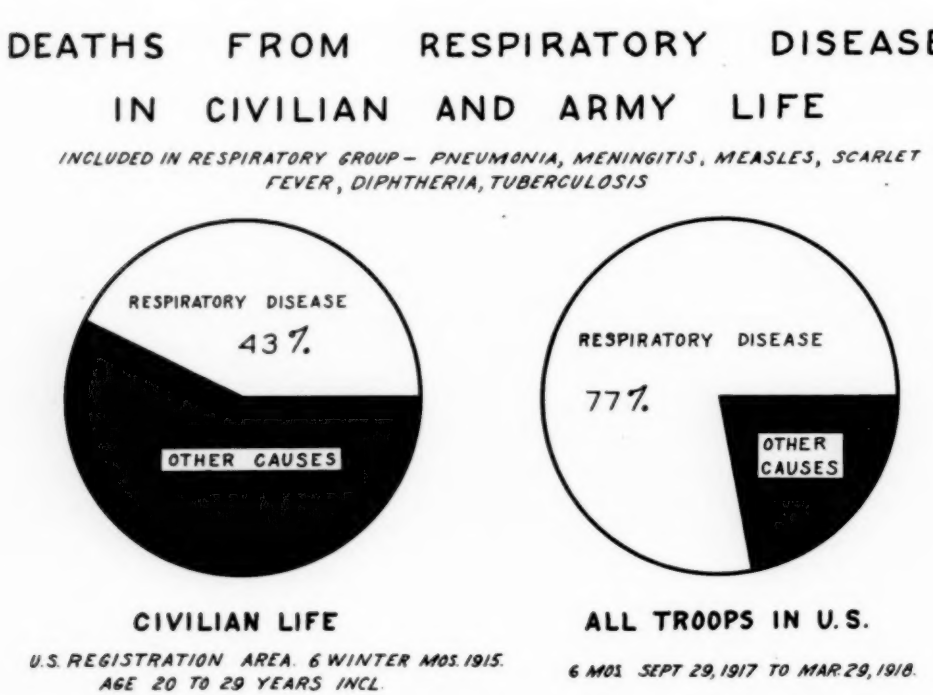

DEATHS FROM RESPIRATORY DISEASE
IN CIVILIAN AND ARMY LIFE
INCLUDED IN RESPIRATORY GROUP – PNEUMONIA, MENINGITIS, MEASLES, SCARLET FEVER, DIPHTHERIA, TUBERCULOSIS
RESPIRATORY DISEASE
43%
OTHER CAUSES
CIVILIAN LIFE
U.S. REGISTRATION AREA. 6 WINTER MOS. 1915. AGE 20 TO 29 YEARS INCL.
RESPIRATORY DISEASE
77%
OTHER CAUSES
ALL TROOPS IN U.S.
6 MOS. SEPT 29, 1917 TO MAR 29, 1918.

Chart IV.

COMPARATIVE DEATH RATES IN NATIONAL GUARD AND NATIONAL ARMY

This comparison can not be made in a satisfactory manner, because the two services have been mixed. The National Guard has been in tents and the Army for the most part in barracks, but in some of the National Guard camps quite half the troops have been select or drafted men. The comparison is, therefore, largely between tent and barrack camps. The additions made to the Regular Army have been in tents. With this understanding the death rates in the three organizations are as follows:

(ANNUAL RATE PER 1000)

National Army	9.6
National Guard	9.5
Regular Army	7.8

Comparing the National Army and the Guard, it will appear that the death rates have been practically the same among soldiers in tents and those in barracks. The lower death rate in the new additions to the Regular Army is believed

to be due to the fact that the average age of the men is greater than in the other organizations, and it is furthermore probable that many of these men have had previous service in the Regular Army. Some figures have been secured at Wheeler which point most consistently to the conclusion that men with previous military training show less sick than new men.

We might make comparison between the National Guards of certain States and the National Army from the same States. This is done in Table 5.

TABLE 5

COMPARISON OF DISEASE INCIDENCE AMONG GUARDSMEN AND NATIONAL ARMY TROOPS FROM SIMILAR DISTRICTS

ANNUAL RATE PER 1000	CAMP AND HOME STATE OF TROOPS					
	New York		Ohio		Illinois	
	N. G. Wadsworth	N. A. Upton	N. G. Sheridan	N. A. Sherman	N. G. Logan	N. A. Grant
Deaths, All Causes	2.5	5.3	2.8	5.4	2.3	3.8
Morbidity						
Pneumonia	9.1	15.0	9.3	15	16	14
Meningitis	.8	.5	1	1.7	.7	1.3
Measles	7.9	6.3	41	65	51	58
Scarlet fever	.8	1.5	1.8	17.3	1	12.3
Venereal disease	77.6	57.2	14	67	132	36.4
*Admission, all causes	14.9	16.0	59.8	28	24.3	17.1

*Average Weekly Admission Rate.

It will be seen from these figures that the death rate in the National Army has, in each case, been higher than in the National Guard. This is probably due to the fact that the National Guard contained more seasoned troops than the National Army. The National Guard Divisions represented in this table were all on the Mexican border in 1916, but were to a variable extent recruited before being assembled in 1917.

CAUSES OF DEATH IN THE ARMY

The diseases which have been responsible for the greatest number of deaths in the army during the period covered by this report are the acute respiratory diseases. These may be named in the order in which they have caused deaths, as follows: pneumonia, meningitis, measles, scarlet fever and diphtheria. With the addition of tuberculosis these have caused seventy-seven (77) per cent of all deaths. Sixteen (16) per cent of deaths have been due to other diseases, and

TABLE 6

(See Chart V) *

CAUSES OF DEATH IN THE ARMY (ALL TROOPS IN THE U. S.) SIX WINTER MONTHS

CAUSE	PER CENT OF TOTAL DEATHS
Pneumonia	61.5
Other diseases than here mentioned	15.3
Meningitis (all kinds)	12.0
External causes	7.1
Tuberculosis	1.7
Measles	1.1
Scarlet fever	.75
Diphtheria	.46
Typhoid fever	.14

seven (7) per cent due to causes other than disease, such as mechanical injuries. (See Chart IV.)

The per cent of total deaths due to each of the more important causes are shown in Table 6.

The acute respiratory diseases have caused an excessive death rate in the army compared with that due to the same causes in civil life. For the age group from 20 to 29 years, in the registration area in the United States for the five years, 1911 to 1915, deaths from the respiratory diseases, including tuberculosis, amounted to forty-three (43) per cent of total deaths.

TABLE 7

ANNUAL DEATH RATE PER 100,000

	PNEUMONIA, ALL FORMS	MENINGITIS	MEASLES	SCARLET FEVER	DIPHTHERIA	TUBERCULOSIS ALL FORMS
Army	559	109	9.4	6.9	4.2	15.3
U. S. Reg. Area	46	2.4	0.5	1.1	1.8	197
Massachusetts	41	2.3	0.3	1.7	1.4	177
Virginia	111	9.1	2.1	0.5	1.1	602

NOTE: The deaths for civilian life are computed for winter months of 1915.

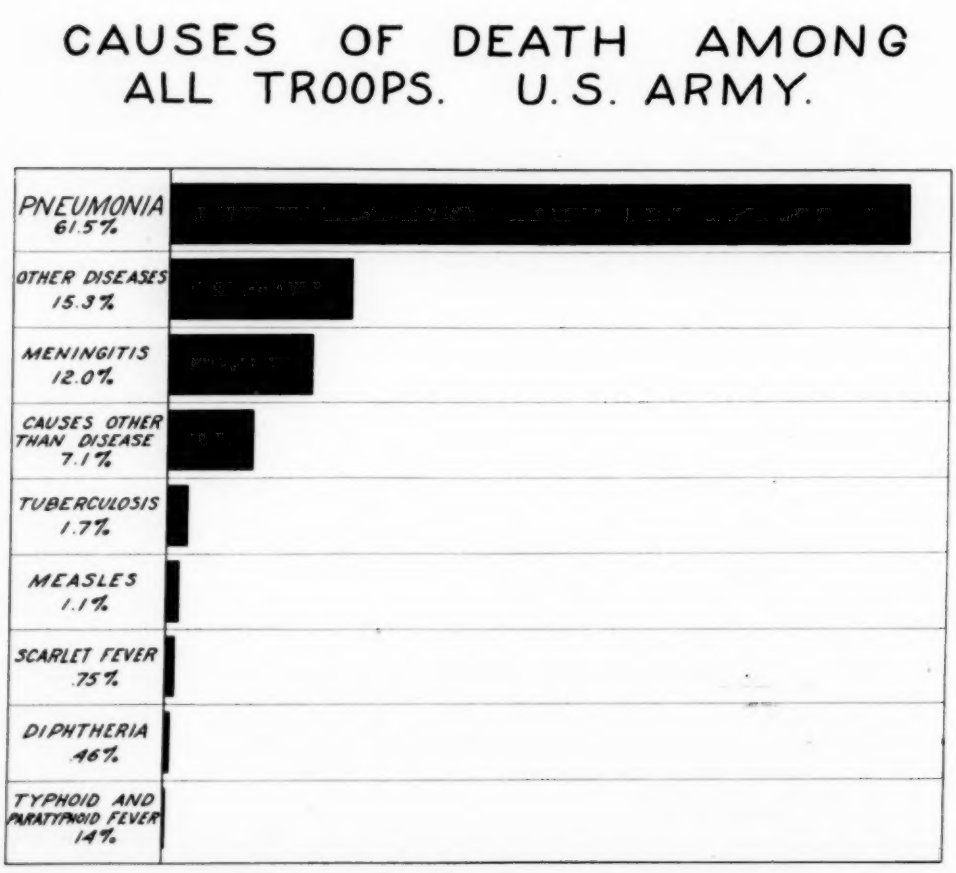

CAUSES OF DEATH AMONG ALL TROOPS. U.S. ARMY.
PNEUMONIA 61.5%
OTHER DISEASES 15.3%
MENINGITIS 12.0%
CAUSES OTHER THAN DISEASE 7.1%
TUBERCULOSIS 1.7%
MEASLES 1.1%
SCARLET FEVER .75%
DIPHTHERIA .46%
TYPHOID AND PARATYPHOID FEVER .14%
6 WINTER MOS. SEPT. 29, 1917 TO MAR. 29, 1918.

Chart V.

Pneumonia has caused by far the greatest number of deaths in the army, and has been responsible for about eighty (80) per cent of total deaths caused by all the respiratory diseases. Comparative figures for army and civil life (for the age period 20 to 29 years) for deaths due to respiratory diseases are given in Table 7.

This table indicates that each respiratory disease, except tuberculosis, has caused an excessive fatality in army life. Assuming the conditions in the registration area for 1915 to be fairly representative of other years, we may express the relative fatality between civilian and army life during the six winter months as follows:

Pneumonia is	12	times	greater	in	the	Army.
Meningitis is	45	"	"	"	"	"
Measles is	19	"	"	"	"	"
Scarlet fever is	6	"	"	"	"	"
Diphtheria is	2	"	"	"	"	"
Tuberculosis is	13	"	"	"	Civil	Life.

It is evident that the low tuberculosis death rate in the army is due to the elimination of those with active forms of this disease. Furthermore, it is probable that most of the deaths from tuberculosis in the army have been due to the activation of inactive foci by acute respiratory diseases.

It is known that the winter covered by this report in the region east of the Rocky Mountains has been one of unusual severity and we might think that this has been partially responsible for the excessive rates in the army camps. A perusal of the figures, however, does not justify this speculation. For instance, in the following table there are given the death rates for pneumonia and meningitis during the past winter from those States from which we have been able to secure data.

TABLE 8

ANNUAL DEATH RATES PER 100,000 DURING SIX WINTER MONTHS

(1915, January, February, March, October, November, December)

ALL AGES

(Instances in Black Faced Type Where Disease During the Past Winter Exceeded That in 1915)

PLACE	PNEUMONIA		MENINGITIS	
	1915	1917-18	1915	1917-18
Vermont	133	102*	6.1	.0*
Massachusetts	199	104*	7.9	4.2*
Rhode Island	202	183	6.6	6.3
Connecticut	190	**220**	10.3	3.8
New York City	227	**265**	4.7	4.3
Indiana	161	148	7.4	**11.0**
Michigan	134	**152**	9.7	9.6
Wisconsin	142	120	6.8	**11.4**
Minnesota	122	86	6.0	1.7
Kansas	133	**143***	4.1	**17.3***
Colorado	218	185	9.2	**12.4**
Montana	171	**199**	5.8	20.0
Virginia	161	158*	11.0	**15.7***
Kentucky	141	**169**	13.5	**22.0**

*NOTE: *Vermont*—Oct., Nov., Dec. only. *Virginia*—Oct., Nov., Dec., Jan. only. *Kansas* and *Massachusetts*—Oct., Nov., Dec., Jan., Feb. only.

Contrasted with the figures for the past winter are the rates for 1915. It will be seen that while the rates have been excessive in some States it is by no means common to all States. Thus the pneumonia rates during the past winter

have been higher than they were three years ago in Connecticut, New York City, Michigan, Kansas, Montana and Kentucky. Pneumonia rates have been lower this year than 1915 in Vermont, Massachusetts, Rhode Island, Indiana, Wisconsin, Minnesota, Colorado and Virginia. Of the fourteen places mentioned seven have had higher meningitis rates in the past winter, whereas the other seven have had lower. It is not evident therefore that the severity of the past winter has produced a bad effect on the pneumonia and meningitis incidence.

SICKNESS IN THE ARMY

While both pneumonia and meningitis have exacted the greatest toll in life, they have not been as important a factor in incapacitating troops as some other causes. Measles is a large factor in this connection. The annual mor-

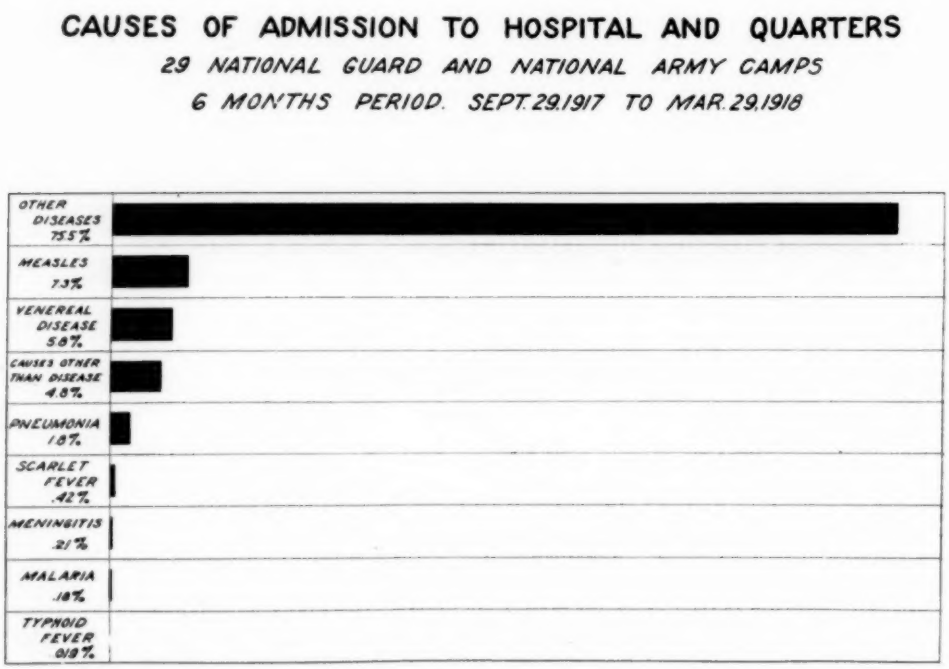

CAUSES OF ADMISSION TO HOSPITAL AND QUARTERS
29 NATIONAL GUARD AND NATIONAL ARMY CAMPS
6 MONTHS PERIOD. SEPT. 29, 1917 TO MAR. 29, 1918
OTHER DISEASES 75.5%
MEASLES 7.3%
VENEREAL DISEASE 5.8%
CAUSES OTHER THAN DISEASE 4.8%
PNEUMONIA 1.8%
SCARLET FEVER .42%
MENINGITIS .21%
MALARIA .18%
TYPHOID FEVER .018%

Chart VI.

bidity rate for measles for all troops in this country during the six months' period was 105. per thousand. The rate for pneumonia was 24.2, that for meningitis 4.1. Pneumonia and meningitis are the more fatal diseases and therefore, although fewer cases occur, the number of deaths is great. The fatality rate, or case mortality rate, for all troops during the six months' period has been 23 per cent for pneumonia, 27 per cent for meningitis and 0.1 per cent for measles.

Most numerous as causes of sickness are those less fatal ailments such as colds, influenza, bronchitis, and mumps. Of the total cases admitted to hospital or quarters, relatively few are caused by the more serious ailments. Taking the National Guard and the National Army camps by themselves, we find that 95.2 per cent of admissions for sickness are due to disease of one form or

another. Of the more serious infectious diseases measles stands foremost, followed by venereal diseases. The relative incidence of the different diseases is shown in Table 9.

TABLE 9

NATIONAL GUARD AND NATIONAL ARMY CAMPS

SIX MONTHS' PERIOD, SEPTEMBER 29, 1917, TO MARCH 29, 1918

CAUSE OF ADMISSION TO HOSPITAL OR QUARTERS

Causes other than disease[1]		4.8%
Measles	7.3	
Venereal disease	5.8	
Pneumonia	1.8	
Scarlet fever	.42	
Meningitis	.21	
Malaria	.18	
Typhoid and paratyphoid	.019	
Diseases other than the above[2]	79.5	
Total diseases		95.2%

*(1) Under this heading are included injuries, sunstroke, sprained ankles, gunshot wounds, etc.
(2) This large group includes the minor and the rare diseases such as colds, la grippe, mumps, whooping cough, bronchitis, influenza, pharyngitis, laryngitis, tonsillitis, chickenpox, smallpox, anthrax, tetanus, etc.

The relative incidence of these various diseases in the different army groups is shown in the following table, where the morbidity from each cause has been expressed as an annual rate per 1000.

TABLE 10

ANNUAL MORBIDITY RATE PER 1000

SIX MONTHS' PERIOD, SEPTEMBER 29, 1917, TO MARCH 29, 1918

	MEASLES	VENEREAL DISEASE	PNEUMONIA	SCARLET FEVER	MENINGITIS	MALARIA	TYPHOID AND PARATYPHOID
Regular Army	57	77.2	17.6	9.9	1.9	1.3	.14
National Guard	132	75.4	31.8	3.0	2.8	3.6	.35
National Army	100	103	25.2	9.4	3.6	2.1	.24

NOTE: Data from 13 National Guard and 16 National Army camps.

The National Army with its new recruits fresh from civilian life shows the highest rate in venereal diseases and meningitis. National Guard troops, however, show the highest rates for measles, pneumonia, malaria and typhoid. Regular Army troops, representing those longest in the service and in all probability an older average age, show the lowest rates in everything but scarlet fever and venereal disease, the latter being slightly above the rate for the Guard.

EPIDEMIC DISEASE IN NATIONAL GUARD AND NATIONAL ARMY CAMPS

Measles, pneumonia, meningitis and scarlet fever have existed in epidemic form in a number of the camps. Measles has been by far the most prevalent of the four. Scarlet fever has been of minor consequence. Typhoid fever has been a negligible factor as a cause of incapacitation. Mumps, bronchitis and influenza have likewise been widespread and although not fatal in themselves, have frequently been forerunners of pneumonia.

PNEUMONIA

As pointed out elsewhere in this paper, pneumonia has been of more serious import than any other single disease. It has occurred in epidemic form in

many camps, particularly in those occupied by southern troops. In other camps, especially those occupied by the troops from the middle western and northern States, pneumonia has been sporadic rather than epidemic. Among the troops from the northeastern section of the country pneumonia has been less prevalent.

In Table 11 are presented the mortality and morbidity rates for pneumonia in the various National Guard and National Army camps.

TABLE 11

SICKNESS AND DEATHS FROM PNEUMONIA IN ARMY CAMPS, SIX MONTHS' PERIOD, SEPTEMBER 29, 1917, TO MARCH 29, 1918

CAMP	ARMY	ANNUAL RATE PER 1000 MORBIDITY RATE	DEATH RATE
Bowie	N. G.	96.	20.0
Wheeler	N. A.	95.	23.6
Travis	N. A.	78.	10.6
Pike	N. A.	63.	24.9
Cody	N. G.	52.	9.7
Beauregard	N. G.	42.	15.0
Taylor	N. A.	37.	5.4
Sevier	N. G.	36.	11.5
Jackson	N. A.	36.	10.7
Doniphan	N. G.	33.	9.0
Dodge	N. A.	29.	5.3
Funston	N. A.	24.	10.5
Kearny	N. G.	24.	4.4
Lee	N. A.	24.	5.5
Shelby	N. G.	21.	4.7
Meade	N. A.	18.	2.6
Logan	N. G.	16.	1.0
Gordon	N. A.	15.	5.3
Sherman	N. A.	15.	2.5
Upton	N. A.	15.	3.6
Grant	N. A.	14.	1.5
Lewis	N. A.	11.	1.5
Devens	N. A.	9.8	2.0
McClellan	N. G.	9.6	1.1
Sheridan	N. G.	9.3	1.7
Wadsworth	N. G.	9.1	1.1
Dix	N. A.	8.0	1.5
Custer	N. A.	7.0	1.5
Hancock	N. G.	6.7	1.1

NOTE: Chart VII shows the morbidity from pneumonia by camps.

The highest pneumonia morbidity rates are at Bowie and Wheeler. These camps along with Pike likewise show by far the highest death rates from this cause. The excessive prevalence of this disease is appreciated on comparing the death rate at Pike with that for Logan, the lowest in the table. The rate at Pike is twenty-five times that at Logan.

As compared with civil life pneumonia has been unduly prevalent in the camps during the past winter. The average pneumonia rate for all camps is high, because of excessive rates at certain of the southern troop camps. The lowest camp rates are not higher than the rates for civilian life. The rate for the New York National Guard troops at Wadsworth, for instance, is 1.1, while the rate for the age group 20 to 29 years in New York City for the six winter months was 1.0. The rate for National Guard troops from Pennsylvania at Camp Hancock is 1.1, as compared with a rate of 1.8 for the age group 20 to 29 years for the city of Pittsburg from October 1, 1917, to April 1, 1918. Nearly

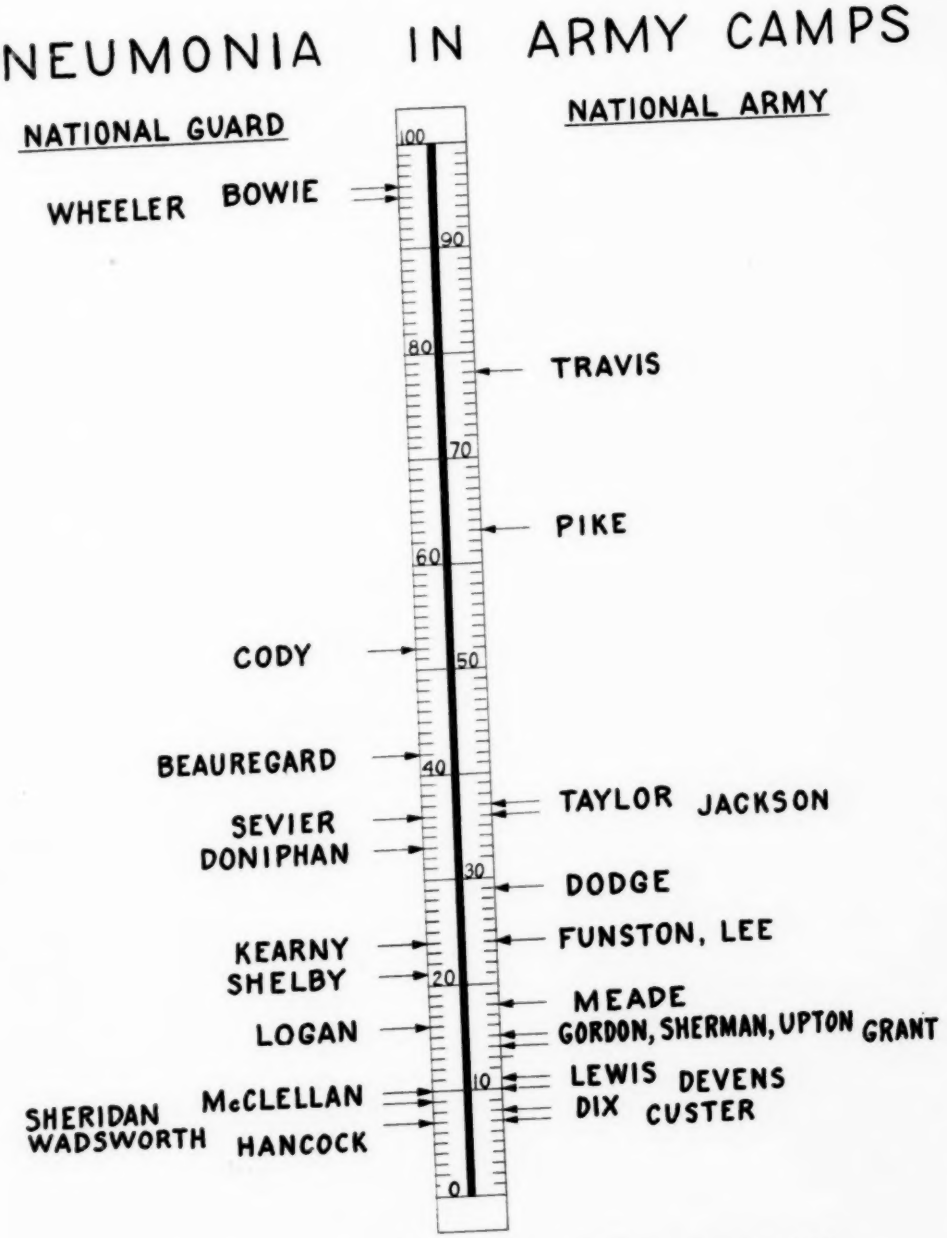

PNEUMONIA IN ARMY CAMPS
NATIONAL GUARD
NATIONAL ARMY
100
90
80
70
60
50
40
30
20
10
0
WHEELER
BOWIE
TRAVIS
PIKE
CODY
BEAUREGARD
SEVIER
DONIPHAN
TAYLOR
JACKSON
DODGE
FUNSTON, LEE
KEARNY
SHELBY
MEADE
LOGAN
GORDON, SHERMAN, UPTON
GRANT
LEWIS
DEVENS
McCLELLAN
DIX
CUSTER
SHERIDAN
WADSWORTH
HANCOCK
ANNUAL MORBIDITY RATE PER 1000
SEPT. 29, 1917 TO MAR. 29, 1918.

Chart VII.

twice as many deaths occurred in Pittsburg as in Pennsylvania men in Camp Hancock.

In New York City during the past winter the pneumonia rate for all ages is 2.65, for age group 20 to 29 it is 1.00. The proportion for the specific age group is thus 38 per cent. In Table 12 there are included pneumonia death rates for the past winter for a number of States. By applying the factor obtained in New York City to the death rates at all ages in other States we may secure a rough approximation of the death rates in age group 20 to 29 years.

TABLE 12

PNEUMONIA DEATH RATES IN CIVILIAN LIFE
ANNUAL RATE PER 1000

PERIOD, WINTER OF 1917-1918

	MONTHS	RATE (ALL AGES)	RATE (AGE 20-29 YEARS)
Vermont	Oct., Nov., Dec.	1.00	.38
Delaware	Oct. to Mar., incl.	7.50*	2.8
Virginia	Oct., Nov., Dec., Jan.	1.58	.60
Connecticut	Oct. to Mar., incl.	2.20	.84
Massachusetts	Oct. to Feb., incl.	1.04	.40
Colorado	Oct. to Mar., incl.	1.85	.70
Michigan	Oct. to Mar., incl.	1.52	.58
St. Louis, Mo.	Oct. to Mar., incl.	2.80	1.1

*This is the figure furnished us by the State Health authorities.

With the data secured in this manner we may strike the comparisons made in Table 12.

It is evident from Table 13 that Army rates are above those for civilian life. There is an exception in the case of Camp Dix whose rate is below that

TABLE 13

COMPARATIVE MORTALITY RATES FROM PNEUMONIA IN ARMY AND CIVIL LIFE
PERIOD, OCTOBER, 1917, TO APRIL, 1918

(FIGURES IN ANNUAL RATES PER 1000)

CIVIL LOCALITY	PNEUMONIA RATE (ESTIMATED RATE AGE GROUPS 20 TO 29 YEARS)	PNEUMONIA RATE	ARMY CAMP	SOURCE OF TROOPS
Vermont Connecticut Massachusetts	.38 .84 .40 } .54	2.0	Devens	New England States
Delaware	2.8	1.5	Dix	Delaware, New York, New Jersey
Virginia	.60	5.5	Lee	Virginia, West Virginia, Pennsylvania
Colorado	.70	10.5	Funston	Colorado, Arizona, Kansas, Missouri, Nebraska, New Mexico, South Dakota
Michigan	.58	1.5	Custer	Michigan, Wisconsin
St. Louis, Mo.	1.1	9.0	Doniphan	Missouri, Kansas

of Delaware. Dix is occupied by New Jersey and New York troops as well as those of Delaware and the Dix rate is not therefore a fair representation for Delaware soldiers. In general, the camp rate for New England is about four times that of civilian life. Camp Lee is about nine times that of Virginia.

Funston is fifteen times that of Colorado. Custer is nearly three times that of Michigan. Doniphan is eight times that of St. Louis. We may conclude that in general camp life is more conducive to pneumonia than civilian life.

Pneumonia prevailed most extensively during November and December. The weekly pneumonia incidence for the army as a whole and for each of the Guard and National Army camps is pictured in Charts XX to XXXV accompanying this report. The rates which we have used in discussing this question are averages for a period of six months. The epidemic nature of the disease in some camps is suggested by the rates during the weeks when the disease was most prevalent. This is shown in Table 14.

TABLE 14

PNEUMONIA MORBIDITY IN CERTAIN CAMPS

FIGURES IN TERMS OF ANNUAL RATE PER 1000

PNEUMONIA RATE

CAMP	AVERAGE SIX MONTHS	HIGHEST WEEK	WEEK ENDING
Bowie	96	468	Dec. 7
Wheeler	95	340	Nov. 23
Sevier	36	187	Nov. 23
Pike	63	172	Nov. 9

Camp Travis differs from the other camps in having a continuously high pneumonia rate and no exceptionally high peaks. Thus the average rate for the six months was 78, whereas the highest week was 169.

DIFFERENCES IN THE VIRULENCE OF THE INFECTING ORGANISMS CAUSING PNEUMONIA

The figures presented in this paper must forcefully impress one with the following facts:

1. Morbidity and mortality in the camps during the period covered by this report have been largely due to the acute respiratory diseases, especially pneumonia and meningitis, the former being the more potent factor in causing the high death rate.

2. The different camps have shown wide variations in morbidity and mortality from pneumonia.

With these facts in mind, one naturally asks, has the pneumonia in the different camps been the same disease or does this diagnostic term include two or more diseases, differing etiologically and possibly in other respects. May the wide differences especially in the mortality rates be explained by the predominance of one pneumonia in a given camp, while quite another disease under the same name has prevailed at another camp?

Clinically, pneumonia has been reported as lobar and broncho. The chiefs of the medical service in the Base Hospitals are men selected from the best clinicians in the country, and they recognize that a positive, sharp and uniform clinical differentiation between the forms of pneumonia is not at present easy. Accepting the diagnosis as reported, which form of pneumonia has been more prevalent and which more fatal? First, what evidence have we concerning the relative prevalence of these two forms of pneumonia?

TABLE 15

CAMP	PERIOD	TOTAL CASES	PER CENT OF LOBAR
Taylor	Oct.-Dec.	186	62
Pike	Oct.-June	528	67
Cody	Oct.-Mar.	537	93
Wheeler	Oct.-Apr.	775	86
Travis	Dec.	124	77
Travis	Apr.	42	64
Shelby	Mar.-Apr.	61	44

It is seen in Table 15 that at all these camps during the months mentioned with the exception of Shelby, lobar pneumonia predominated. It is reported from some camps that the dominant form of pneumonia changes with the arrival of new troops. Most of the camps, not all, report that bronchopneumonia has been the more fatal. The case mortality at Pike is reported at 57 per cent in broncho and 36 in lobar. At Cody the differences showed slightly higher mortality in the lobar form. It is generally agreed that bronchopneumonia is more frequently a secondary infection, especially after measles.

At Sevier there has been no recognized streptococcus pneumonia. The pneumococcus has been the causative agent in both lobar and bronchopneumonia and the prevailing organism has been Type IV.

In this camp a hookworm survey showed 18.6 per cent of the healthy soldiers infected with these parasites. Of total admissions to hospital 20 per cent were infected. Among the bronchopneumonia cases 50 per cent of those who died had hookworm, while among those who did not have this infection only 17 per cent died.

The Base Hospital laboratories have been well equipped and manned, and much valuable work has been done in the identification of the bacteria and the differentiation of the types of pneumonia. We are leaving to others a more complete digest of this work. In most of the laboratories Type IV has been reported as the predominating organism.

A more important matter is the prevalence of a pneumonia in which the streptococcus hemolyticus appears as the causative agent. This coccus is reported as causing both lobar and bronchopneumonia and the pneumonia caused by it appears to be more frequently complicated with empyema, and more fatal than that due to the pneumococcus.

The epidemiologist at Camp Upton reports as follows:

Case No. 1. The first case of streptococcus hemolyticus pneumonia to be admitted to the Base Hospital was a white man, assigned to the Depot Brigade, and sent to the hospital immediately upon his arrival on December 25, 1917, from Fort Slocum. He gave a history of having been seized with a severe chill and a sharp pain in the right lower chest, before leaving Fort Slocum. The streptococcus hemolyticus was identified in the laboratory two days after admission, and was later found in the empyemic fluid. This man died on January 17, and no other information concerning him is available, except that he was twenty-five years old and had been in the service less than one month. Following this initial case, there were 14 admitted to the hospital previous to March 1. Nine, or 64 per cent of these are colored, while during the same period the average strength of colored troops in camp was 3,380 or only about 10 per cent of the average strength of the camp. The troops stationed at Camp Upton during the winter were for the most part drafted men from the New York metropolitan area. A conservative estimate places the number of urban troops at 90 per cent of the command. In contrast to this, 56.5 per cent of the 48 cases of pneumonia due to the streptococcus hemolyticus admitted up to April 1, were rural men.

Case No. 2 was a rural colored man from Texas, who arrived early in December from Camp Pike.

Case No. 3 was a rural colored man from Virginia, who had just arrived from Camp Lee.

Case No. 4 was an urban white man from Maine, who had been assigned to the Medical Department and who was on duty in the contagious section of the Base Hospital.

Case No. 5 was a colored Texas farmer, recently arrived from Camp Pike.

Case No. 6 was a Connecticut man, who arrived together with case No. 1 from Fort Slocum on December 25.

Case No. 7 was a colored Texas man, sent here from Camp Pike.

Case No. 8 which did not develop until January 28, was a white man from Cornwall, N. Y., on duty at the Officers' Training School.

These eight cases are all that developed prior to the first of February. It is seen from this that two of the first eight cases were imported from Fort Slocum, and three from Camp Pike, the latter camp having experienced much pneumonia during November and the first part of December. Camp Pike reported 316 pneumonia cases during this period. The early pneumonia cases at Upton among colored troops were all in the 367th Infantry, which drew its men for the most part from Camps Pike and Lee and New York City. The urban men from New York City remained practically uninfected. Having been introduced into Camp Pike, the virulent streptococcus infection spread gradually through the association of troops in camp until it assumed rather large proportions in March, with a total of 33 cases for that month. The mortality rate up to April 1st was 48 per cent.

We are convinced that the differences in morbidity and mortality from pneumonia in the camps are not explained on the ground of variations in kind or virulence of the infecting organisms.

DIFFERENCES IN SUSCEPTIBILITY TO PNEUMONIA OF THE MEN IN DIFFERENT CAMPS AND THE EXPERIENCES OF THE CIVIL WAR IN THIS CONNECTION

Our figures show most convincingly:

1. That men from rural communities are more susceptible to pneumonia than are those from urban life.

2. That on the whole the southern soldier is much more susceptible to this disease than his northern comrade.

The fact that pneumonia has been much more prevalent and much more fatal among southern than among northern troops has led us to look up the history of the acute respiratory diseases during the Civil War. Superficial examination of the "Medical and Surgical History of the War of the Rebellion"* from which the quotations which follow are taken, shows that the acute respiratory diseases during the Civil War followed along the same lines as they have exhibited in our camps during the period covered by this report. We herewith present a brief résumé of the acute respiratory diseases as they appeared in the Civil War. During that war, there were reported in the Union Army 67,763 cases of measles with 4,246 deaths, giving a mortality rate of 6.27 per cent. It is more than probable that only a small part of this mortality was directly due to measles, but to certain sequalæ, notably pneumonia. The average annual morbidity rate of measles per thousand of strength was 30.41, the maximum 77.57 during the first year, and the minimum 1.98 during the last year. Although there are no exact reports, it appears that measles prevailed in the Confederate Army and was much more highly fatal than in the Union Army. Prof. Paul F. Eve says concerning measles:

*Part Third Medical Volume.

"In the Confederate Army measles prevailed extensively in the new regiments, especially in those from the country, and greatly impeded their organization. It so diminished the effectiveness of the troops and proved so fatal in camps that companies, battalions and whole regiments had to be disbanded for a time and the men sent home." (p. 649.)

"As the new men came within the influence of the contagious foci, the disease spread, giving a sudden elevation to the line of prevalence, which therefore fell until fresh accessions occasioned a corresponding rise in level. The highest rates occurred in the early months when the commands were small and unprotected by previous attacks. In subsequent periods, the increased prevalence of rates, if calculated on the strength of the new regiments only, would probably have been equally high, but calculated, as they have been, on the mean strength, part of which had lost its susceptibility to the disease, they are necessarily lower than those of the earlier epidemic periods." (p. 649.)

"Recruits from the city are more likely to have passed through the disease in childhood than those from rural districts. City regiments are, therefore, to be preferred in this connection." (p. 659.)

The advisability of intentionally subjecting men to measles under proper sanitary conditions was considered:

"Inoculation for smallpox was practiced before the discovery of vaccination. However, the efforts of sanitary officers have been so successful in controlling the spread of communicable diseases that few medical men would counsel the intentional propagation of measles among large bodies of newly organized and susceptible troops." (p. 659.)

"Isolation proved ineffective in restricting the disease during the war, but there is no record of its having been systematically carried out." (p. 659.)

"Scarlet fever was rarely seen during the Civil War. Among the white troops 578 cases were reported, 70 of which or 12.1 per cent were fatal. Among colored troops the cases numbered 118 with but 2 deaths, equivalent to a mortality rate of only 1.7 per cent. This was, therefore, one of the exceptional diseases less fatal to the negroes than to the white men." (p. 662.)

"Mumps occurred to a notable extent immediately in the first year of the war, when 40 cases were reported among every one thousand men; the rate of prevalence fell to 23 in the second and third year, to 14 in the fourth year and to less than three in the fifth year." (p. 675.)

"The average annual morbidity from pneumonia among white troops was 27.8 and the death rate 6.21. Among colored troops the annual morbidity was 88 and the mortality 27.29." (p. 719.)

"Pneumonia was much more prevalent among the Confederate than among Federal troops. Among the former this disease annually affected 103 men of every one thousand, while the corresponding rate for Federal white troops was 34, and the cases reported as acute bronchitis and catarrhs numbered 415 yearly per thousand among Confederate troops as against 192 in the Union ranks." (p. 719.)

Among the Confederate troops operating in South Carolina, Georgia and Florida during the 19 months, January, 1862, to July, 1863, inclusive, there were 2,220 cases of pneumonia of which 127 terminated fatally in the field and 370 in the hospital, making a total of 497 deaths, equivalent to 22.4 per cent of the whole number of cases. (p. 720.)

A table shows a Confederate death rate from pneumonia of 20.6 per thousand strength as compared with the Union rate of 7.8 per thousand. The average annual rate of deaths from pneumonia among southern prisoners in northern camps was 59.9 per thousand, while the annual rate from the same cause at Andersonville was 27.4.

Acute bronchitis was reported as responsible for 168,715 cases of sickness in the Federal Army, and of these 650 terminated fatally. This applies only to white troops. Among the colored troops, the average annual rate for bronchitis was 123.5. (p. 726.)

Additional evidence of the greater susceptibility of the southern soldier to the acute respiratory diseases is supplied by the following figures (see Table 15-A), furnished by the "Sick and Wounded" Division of the Surgeon General's Office. These figures cover the calendar year of 1917, and they give the native

TABLE 15-A

LOBAR PNEUMONIA, BRONCHOPNEUMONIA AND MEASLES, AMONG U. S. TROOPS, ACCORDING TO NATIVITY

ENLISTED MEN, YEAR 1917

State of Birth	ANNUAL ADMISSION RATE PER 1000*		
	LOBAR PNEUMONIA	PRIMARY BRONCHO-PNEUMONIA	MEASLES (UNCOMPLICATED)
Alabama	.233	.029	1.35
Alaska			.08
Arizona	.049		.22
Arkansas	.128	.065	1.36
California	.045	.013	.34
Colorado	.043	.015	.26
Connecticut	.028	.006	.08
Delaware	.020	.015	.13
District of Columbia			
Florida	.381	.042	1.45
Georgia	.153	.029	.88
Idaho	.043		.15
Illinois	.054	.008	.27
Indiana	.060	.017	.57
Iowa	.088	.010	.43
Kansas	.104	.013	.75
Kentucky	.111	.016	.82
Louisiana	.122	.056	1.14
Maine	.027	.008	.31
Maryland	.035	.009	.11
Massachusetts	.027	.004	.09
Michigan	.038	.007	.23
Minnesota	.043	.006	.21
Mississippi	.131	.038	1.26
Missouri	.101	.015	.61
Montana	.009	.001	.19
Nebraska	.128	.011	.49
Nevada	.049		.11
New Hampshire	.035	.012	.16
New Jersey	.022	.008	.06
New Mexico	.046	.018	.23
New York	.025	.006	.07
North Carolina	.056	.015	.79
North Dakota	.033		.22
Ohio	.042	.009	.18
Oklahoma			
Oregon	.042	.009	.31
Pennsylvania	.030	.006	.08
Rhode Island	.018	.007	.04
South Carolina	.079	.018	.66
South Dakota	.053	.005	.32
Tennessee	.099	.027	1.21
Texas	.231	.054	1.58
Utah	.032	.005	.21
Vermont	.005	.002	.40
Virginia	.039	.011	.36
Washington	.059	.005	.11
West Virginia	.030	.009	.28
Wisconsin	.050	.009	.44
Wyoming	.041		.25
Totals	.067	.014	.43

*Number of admissions for men of any one state divided by the population of that state, times 1000.

state of all soldiers who had measles or pneumonia during that year, quite independently of the organizations to which they belonged or the locations where they became ill. These figures have great relative value and show most convincingly the greater susceptibility of southern men to these diseases. It must

not be inferred that this higher susceptibility is inherited. At least such an assumption is not warranted, since it is more than probable that most of these men lived for the greater part of their lives in the states in which they were born. For the proper interpretation of these figures, we may say that during the year 1917, Alabama furnished out of every 100,000 of its population, 135 soldiers who contracted measles during that year.

It will be seen from the above that then, as now, measles, mumps and pneumonia were highly prevalent among the troops, both North and South, but that measles and pneumonia were much more prevalent and much more fatal among southern than among northern soldiers. Sickness and death in camp have been greatly lessened since Civil War days as Chart VIII will show.

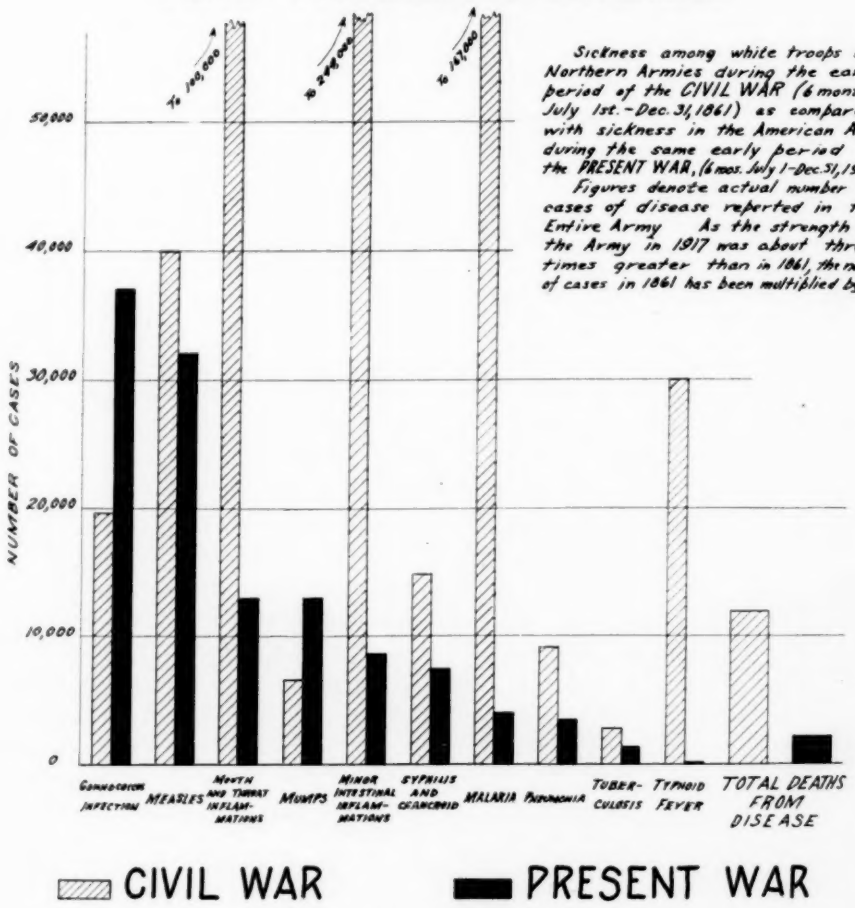
If we can explain why the rural man is much more susceptible to pneumonia than his urban brother and why the southern soldier is much more susceptible to the same disease than his northern comrade, we will have a basis on which to work in our attempts to lessen the morbidity and mortality from pneumonia in our camps. We are aware that we are only on the threshold of this investigation and that more extensive and exact data may modify our views, possibly radically change them, but at the risk of falling into error, we are venturing certain suggestions.

In the first place we recognize that no sharp line can be drawn between rural and urban life. It is customary to classify those communities with a population of less than 2,500 as rural, but this is arbitrary and we must recognize the fact that our population is not fixed but is in a condition of constant flux. Because a soldier comes from a farm does not mean that he has not passed much of his life, even recently, in some crowded community, but the large masses of men with which we are dealing may justify a rough classification into rural and urban. Camp life is more crowded than that of most conditions of civilian life, even in the most densely congested areas of our largest cities. When we speak of "crowding" in camp, we are most likely to have in mind sleeping quarters and we demand in these not less than 50 square feet of floor space per man, but while proper space in sleeping quarters is a matter of importance, men may be dangerously crowded even out of doors. The acute respiratory diseases are transmitted by the transference of organisms from the respiratory tract of one man to those of another. To put it bluntly, "by spitting into one another's face," and this occurs more frequently in the waking than in the sleeping hours. Crowding in camp life is a military necessity. It may be reduced to a minimum, and every effort should be made to do this. In an assembly hall in one of our camps where several thousand men are seated night after night, if every man sits upright and moves his head neither backward nor forward, the greatest distance between his nose and that of the man in front or behind is 26 inches, and to right or left, 16 inches. In such an assembly with one-half the men coughing, one can have some idea of the extent to which respiratory bacteria are being transmitted. This condition would not be materially altered by the removal of the walls and roof of the hall. On the other hand, the transfer of respiratory bacteria may be quite indirect. They may be carried in dust, and it is not surprising that the acute respiratory diseases have increased after dust storms as has been shown to be the case at Funston, Bowie and at other camps.

THE FRUITS OF PREVENTIVE MEDICINE

BY MAKING USE OF OUR INCREASING KNOWLEDGE OF MEDICINE AND SANITATION SINCE CIVIL WAR TIMES IT HAS BEEN POSSIBLE TO PREVENT HALF A MILLION CASES OF DISEASE AND SAVE THE LIVES OF

TEN THOUSAND SOLDIERS



Sickness among white troops in the Northern Armies during the early period of the CIVIL WAR (6 months, July 1st.-Dec. 31, 1861) as compared with sickness in the American Army during the same early period of the PRESENT WAR, (6 mos. July 1-Dec. 31, 1917.)

Figures denote actual number of cases of disease reported in the Entire Army As the strength of the Army in 1917 was about three times greater than in 1861, the number of cases in 1861 has been multiplied by three.

Chart VIII.

Pneumonia is an urban or a crowd disease in both civilian and military life. Our camps are the most crowded cities in our country, and consequently they furnish the highest rates for the respiratory diseases.

The man who has lived in a densely populated area is more resistant because he has been exposed to the same bacteria before, probably many times, and has acquired more or less immunity or an increased resistance. For a converse reason, the man who has lived in a sparsely settled community is the more susceptible because he has never before, or has not recently, harbored these bacteria. We call attention to the maps showing the location of the camps and areas from which their soldiers were drawn. (See Charts XVIII and XIX.) The soldiers less susceptible to pneumonia are from the most densely populated areas.

In the South, under ordinary conditions of civilian life, pneumonia is relatively rare, but when it does appear, is highly fatal, and is highly fatal because it is rare. The average southern lad has never come, or but seldom been brought, into contact with the organisms which cause pneumonia and when they are sprayed into his face, he falls a ready victim just as the American Indians and Fiji Islanders were decimated by measles and, as smallpox aided the Spaniards in their conquest of Mexico. Many illustrations along this line will occur to the student of epidemiology.

MEASURES FOR PROTECTION AGAINST PNEUMONIA AND OTHER RESPIRATORY DISEASE

In our efforts to lessen morbidity and mortality from the acute respiratory diseases, especially pneumonia, we must endeavor to develop the resistance of the soldier to the causative organisms. In the accomplishment of this purpose many procedures are possible. Up to the present time we have relied upon attempts to limit the number of infecting organisms finding access to the susceptible man by wearing masks, by placing the sick in cubicles, by the employment of disinfecting agents, etc. These methods have probably been of value—how much we can not say—but they are applicable only to the sick in hospitals, in detention camps or in quarters, and are not applicable to the great masses of the soldiers. The most scientific and the most promising procedure lies in vaccination. This has been tried already in some camps. At Upton, more than 12,000 out of a division of about 30,000 were vaccinated against pneumonia, and during the following two months that the practically unbroken division was under observation, the protective value of the vaccination seemed to be quite in evidence. In other camps, vaccination has been cautiously used, but up to the present time there have been established no standard methods, and it would be premature to make any definite claims. It is worthy of note that in South Africa vaccination against pneumonia has been reported with at least the promise of success. Enough has been done along this line to demonstrate that vaccination with pneumocci, properly done, results in no injury. In this procedure, the number and virulence of the organisms introduced are absolutely under control. It is the scientific method of increasing resistance. It is not probable that the increased resistance to pneumonia secured by any method continues indefinitely, since one attack of the disease does not protect for any great length of time, at least, against subsequent infection, but temporary advances in resisting power would be of great service.

We might learn something from the natural process by which increased resistance to the acute respiratory diseases is developed. This apparently is secured by gradual adaptation to the conditions of crowd life. Instead of taking our new soldiers from the comparative isolation of rural life and placing them immediately in crowded camps, they should be assembled in small groups at their homes, drilled and prepared for camp life more gradually. There should be a reserve army and for every man sent to a training camp, two should be added to the reserve army. These men should be permitted to continue their civilian functions, but should wear a distinctive uniform, be under strict discipline, have their vaccinations and drill in squads of gradually increasing size and thus slowly be introduced to the conditions of crowd life.

The difference between the "raw" and "seasoned" soldier so far as susceptibility to the infectious diseases is concerned is in our opinion explainable as here suggested. The former is without previous recent exposure to "crowd" bacteria and falls a ready victim. The latter, on account of frequent exposure to "crowd" bacteria shows a certain degree of immunity or at least increased resistance. The present method of mobilization is conducive to the spread of the acute respiratory diseases. For instance, select men in Florida are assembled at certain points in that state, and shipped to Camp Wheeler in Georgia in troop trains. It has appeared that as many as 6 cases of fully developed measles have been found on one of these trains on its arrival at Camp Wheeler. Those reaching the camp not actually ill are sent to the Depot Brigade or a Detention camp. On a certain day a colored contingent of drafted men from Alabama who had never been in a camp, reached Camp Custer in Michigan, and were placed in the Depot Brigade. During the following month, the epidemiologist at Custer reported "80 per cent of the cases of pneumonia arose in the Depot Brigade, which is the receiving place and also the distributing point for arriving recruits." Moreover, the type of the dominant pneumonia at Custer changed after the arrival of the Alabama troops. This experience has a parallel in many camps. It is worthy of note that of the 86 cases of pneumonia reported from Custer for the month following the arrival of the Alabama contingent, 69 came from the Depot Brigade, and of these 50 from the Alabama contingent.

The plan of having several hundred naked men closely crowded pass through the physical tests appears to be, at present, a military necessity, but that it affords ready means for the distribution of the acute respiratory diseases, is evident. It would be far better if all these examinations, vaccinations, etc., could be done in the reserve army which has been suggested. The transfer from the comparative individualism of civilian life to the intense communism of military life should be more gradual. The impossibility of bringing an effective army into existence "over night" is as evident to the sanitarian as it is to the military man.

To hope to reduce infection among our soldiers to the minimum without adequate attention to the health of the civilian population from which the soldier comes and with which he mingles more or less freely is without justification. If it be wise to protect the soldier by compulsory vaccination against smallpox and typhoid fever, why is it not right to protect the prospective soldier, the young man who is to be called next month or next year, against the same infections in the same way? All the infections which have appeared in the camps are dis-

tributed among the civilian population from which the soldiers in the camp have come. As an illustration, the figures in Table 16 show the present prevalence of infections in North Carolina. The figures indicate new cases reported every week

TABLE 16

INFECTIOUS DISEASES IN THE STATE OF NORTH CAROLINA FROM APRIL 6 TO JUNE 29, 1918

	APRIL				MAY				JUNE				
	6	13	20	27	4	11	18	25	1	8	15	22	29
Whooping cough	177	198	273	263	337	298	387	355	467	567	443	993	476
Measles (both kinds)	338	365	337	386	325	201	275	298	211	149	138	95	93
Diphtheria	18	9	19	14	10	16	12	16	8	8	9	14	10
Scarlet fever	11	6	4	10	2	8	7	8	7	2	11	15	18
Septic sore throat									5	6	5	1	5
Smallpox	31	13	18	32	36	52	14	15	18	11	13	17	17
Chickenpox								14	15	21	16	7	5
Infantile paralysis								3	1			1	1
Typhoid fever	10	8	6	6	7	12	11	12	17	29	48	76	98
Meningitis	5	2	3	6	1	3	2	5	1	3	3	1	1

Draft men from all parts of North Carolina are being sent to Jackson and Sevier and carry the infections with them. These arrivals consist of infected and susceptible material. They carry both the spark and fuel. If these men were organized and drilled in small squads at home and gradually inducted into military life, and only those found to be free from infection sent to the camps, the control of communicable disease among the soldiers would be greatly aided.

MEASLES

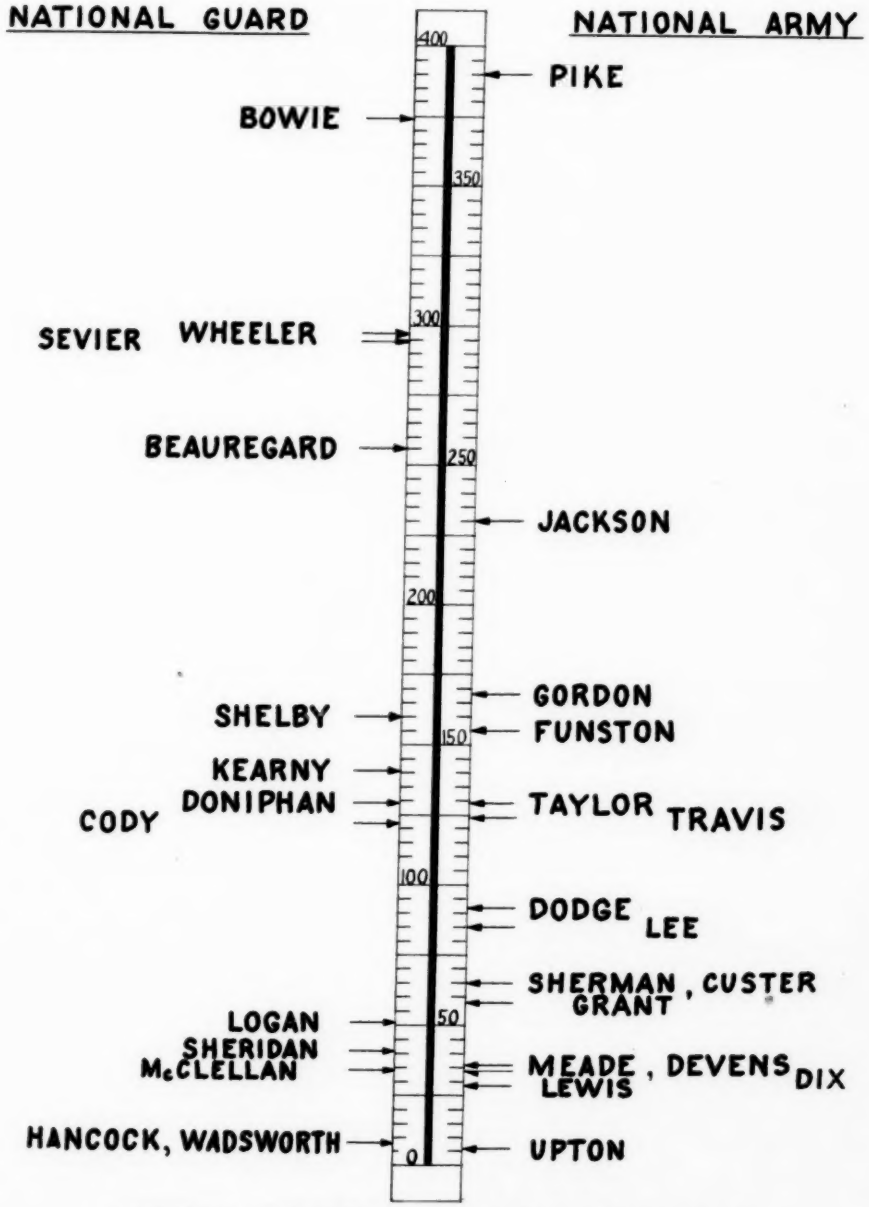
The morbidity from measles presents an entirely different picture from that of pneumonia. The highest morbidity rate from pneumonia was fourteen times that of the lowest. In the case of measles the highest rate was 62 times that of the lowest. Measles is thus seen to be much more epidemic in character. It exhibits an explosive characteristic in the suddenness with which it breaks forth and recedes. This is illustrated in the case of Camp Wheeler. The dates and morbidity rates were as follows:

TABLE 17

FOR WEEK ENDING	ANNUAL MEASLES MORBIDITY RATE PER 1000
Oct. 19	83
Oct. 26	428
Nov. 2	615
Nov. 9	1760
Nov. 16	2200
Nov. 23	1120
Nov. 30	248
Dec. 7	240
Dec. 14	19

Measles was present to an excessive degree in about the same camps that experienced trouble from pneumonia. Southern troops suffered most severely from this sickness. The mortality from measles is of course a minor factor when compared to that from pneumonia. Measles, however, has been a serious disease because in addition to the time lost and the great numbers incapacitated,

MEASLES IN ARMY CAMPS



ANNUAL MORBIDITY RATE PER 1000
SEPT. 29, 1917 TO MAR. 29, 1918.

Chart IX.

it has been a forerunner of pneumonia in many instances. We are still in doubt concerning the relation between these diseases.

From statistics collected during the month of February at Camp Wheeler, it was found that 14 per cent of the pneumonia cases were preceded by measles. It is believed that this figure is much higher in some of the other camps. Including measles, mumps and colds of one kind or another, this group of diseases preceded pneumonia in 68 per cent of the pneumonia cases at Wheeler.

The average morbidity rates for measles in each camp, as well as the mortality rates, are given in Table 18.

TABLE 18

MORBIDITY AND MORTALITY FROM MEASLES IN ORDER OF PREVALENCE AT NATIONAL GUARD AND NATIONAL ARMY CAMPS

(Six Months' Period, September 29, 1917, to March 29, 1918)

FIGURES REPRESENT ANNUAL RATE PER 1000

CAMP	ARMY	MORBIDITY RATE	DEATH RATE
Pike	N. A.	390	.15
Bowie	N. G.	374	0
Wheeler	N. G.	297	0
Sevier	N. G.	294	.15
Beauregard	N. G.	256	.11
Jackson	N. A.	230	.33
Gordon	N. A.	168	.21
Shelby	N. G.	160	.16
Funston	N. A.	155	.07
Kearney	N. G.	141	0
Taylor	N. A.	129	0
Doniphan	N. G.	129	.08
Travis*	N. A.	124	0
Cody	N. G.	122	0
Dodge	N. A.	92	0
Lee	N. A.	85	.19
Sherman	N. A.	65	.38*
Custer	N. A.	65	.49
Grant	N. A.	58	.08
Logan	N. G.	51	0
Sheridan	N. G.	41	0
Meade	N. A.	36	0
Devens	N. A.	36	0
McClellan	N. G.	34	0
Dix	N. A.	34	0
Lewis	N. A.	28	0
Hancock	N. G.	8	0
Wadsworth	N. G.	7.9	0
Upton	N. A.	6.3	0

*This rate is lower than it should be as many cases were not reported in the fall of 1917. See Chart IX for Measles morbidity in camps.

The highest mortality rate from measles was at Camp Custer. Even this rate is small, compared to that for pneumonia. It may be pointed out that many camps with high measles rates show few or no deaths from this cause. This is explained by the fact that the more serious cases were complicated with pneumonia and the death charged to this cause instead of measles. This is a more probable explanation than any difference in virulence of the infecting organism. It seems highly improbable that the case mortality rate at Camp Bowie should be zero while that at Camp Custer was about 0.8 per cent. With a case mortality rate of 0.8 per cent at Bowie we should have had a death rate of about 3.0 per 1000.

Comparative measles statistics for civilian life are obtainable only in an

indirect manner. The morbidity rates from this cause for the six winter months of the past year range from 1.0 per 1000 for the State of Vermont to 12.4 per 1000 for the State of Virginia. These rates are for people of all ages. Inasmuch as the mortality from measles for the age group 20 to 29 years is but a few per cent of that for all ages, it is probably that the morbidity rates for the States and cities rarely approach 1.0 per 1000.

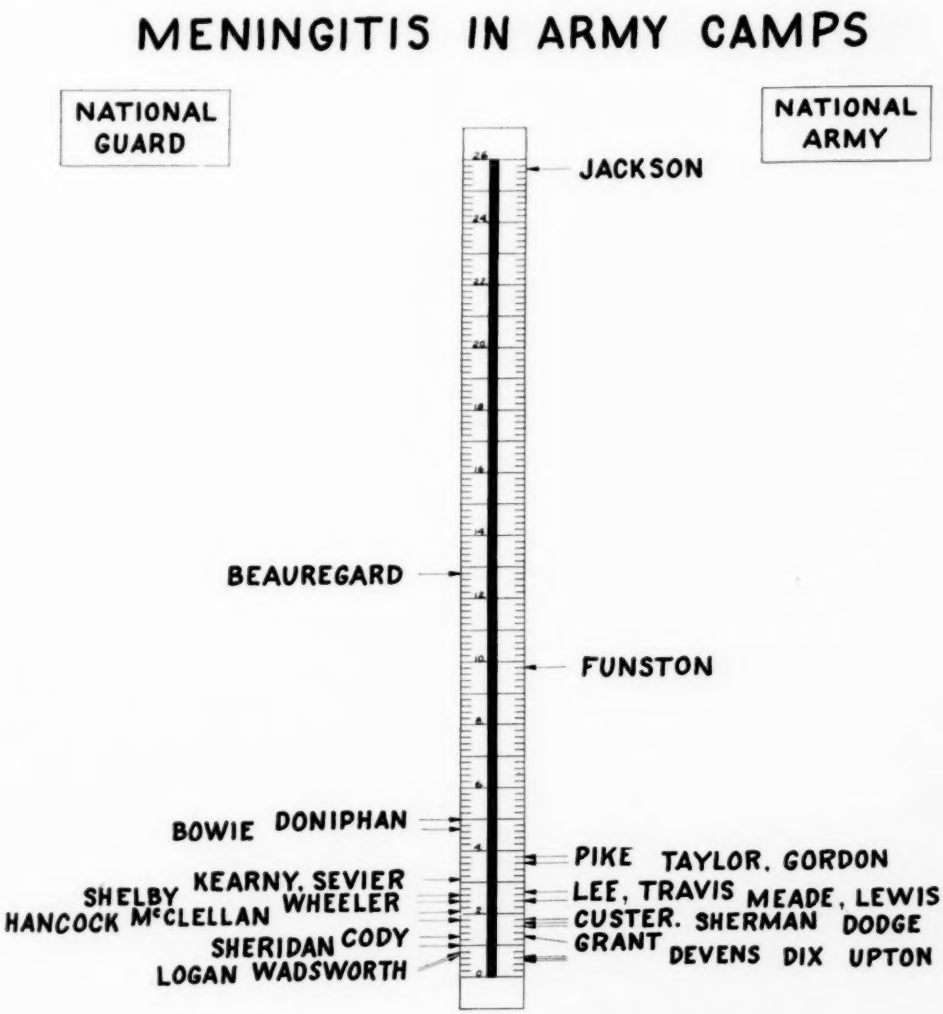


Chart X.

As the morbidity rate for all National Guard and National Army camps was over 6.0, it is quite evident that measles has been appreciably greater in the army. The weekly incidence of measles has been pictured on the charts for pneumonia already mentioned.

MENINGITIS

Meningitis in its various forms has appeared in every camp during the six winter months. The prevalence of this disease at Camp Jackson, however, has stood out above that of all other camps. The morbidity here has been just twice that of the camp having the next highest rate. Next to Jackson stand Beauregard and Funston. These rates are 25.7, 12.8 and 9.8, respectively. Next comes Doniphan with 5.0 and the other camps follow with rates at close intervals, the figures receding gradually from this point. (See Table 19.)

TABLE 19

MENINGITIS (ALL FORMS) IN NATIONAL GUARD AND NATIONAL ARMY CAMPS
FIGURES REPRESENT ANNUAL RATE PER 1000

CAMP	ARMY	MORBIDITY RATE	DEATH RATE
Jackson	N. A.	25.7	7.5
Beauregard	N. G.	12.8	7.7
Funston	N. A.	9.8	3.6
Doniphan	N. G.	5.0	1.8
Bowie	N. G.	4.7	1.6
Pike	N. A.	3.8	2.4
Taylor	N. A.	3.6	1.3
Gordon	N. A.	3.6	.96
Sevier	N. G.	3.1	1.1
Kearny	N. G.	3.1	.77
Lee	N. A.	2.7	1.2
Travis	N. A.	2.7	2.5
Shelby	N. G.	2.6	.71
Wheeler	N. G.	2.4	2.1
Meade	N. A.	2.4	.66
Lewis	N. A.	2.4	.67
McClellan	N. G.	2.1	.41
Hancock	N. G.	1.8	.44
Custer	N. A.	1.8	.30
Sherman	N. A.	1.7	.32
Dodge	N. A.	1.6	1.1
Cody	N. G.	1.3	.50
Grant	N. A.	1.3	.31
Sheridan	N. G.	1.0	.18
Wadsworth	N. G.	.78	.20
Logan	N. G.	.73	.22
Devens	N. A.	.63	.28
Dix	N. A.	.57	.19
Upton	N. A.	.54	.34

(See Chart X for Meningitis Morbidity in camps.)

The three camps with highest morbidity rates likewise have the highest death rate. Beauregard, however, shows a death rate even greater than Jackson. Again, it is the southern troops who have suffered most severely from this disease. Those escaping it are the troops from the northeastern and northern sections of the country.

Meningitis, next to pneumonia, has been the most serious disease that the Medical Corps of the Army has had to meet. It is serious by reason of its high fatality and also because this of all diseases shows the greatest excess over the disease in civilian communities. It will be recalled from the early part of this report that meningitis was estimated to be 45 times as prevalent in the Army as in civilian life, whereas the figure for measles was 19 and for pneumonia 12. For this past winter we have the figures only for New York City and Pittsburgh, within the age group 20 to 29 years. The annual death rate for meningitis per

1000 was .038 for New York and .047 for Pittsburgh. The death rate for all ages in New York City was .043. The rate for age group 20 to 29 years is thus 88 per cent of that at all ages. Applying this factor to the rates in the various states we can obtain a rough approximation of the rates for the specific age group in these states. (See Table 20.)

TABLE 20

MENINGITIS IN CIVIL COMMUNITIES

FIGURES REPRESENT ANNUAL DEATH RATE PER 1000

PLACE	RATE FOR ALL AGES	RATE FOR AGE 20 TO 29 YEARS (COMPUTED BY USING NEW YORK CITY FACTOR OF 88%)
Vermont	.0	.0
Virginia	.16	.14
Delaware	.12	.11
Connecticut	.038	.034
Massachusetts	.042	.037
Colorado	.12	.11
Michigan	.096	.085
St. Louis, Mo.	.047	.042
New York City	.043	.038

Accepting the rates thus obtained for what they are worth, we may contrast these figures with those for various army camps. (See Table 21.)

TABLE 21

MENINGITIS IN CIVIL LIFE (AGE 20 TO 29 YEARS) AND ARMY CAMPS
ANNUAL DEATH RATES PER 1000

Six Winter Months, 1917-18

PLACE	RATE		RATE	CAMP	SOURCE OF TROOPS
Vermont	.0				
Connecticut	.034	.024	.28	Devens	New England States
Massachusetts	.037				
Virginia	.14		1.2	Lee	Virginia, West Virginia, Pennsylvania
Delaware	.11		.19	Dix	Delaware, New Jersey, New York
Colorado	.11		3.6	Funston	Colorado, Arizona, Kansas, Missouri, Nebraska, New Mexico, South Dakota
Michigan	.085		.30	Custer	Michigan, Wisconsin
New York City	.038		.27	.20 Wadsworth	New York
				.34 Upton	New York
Pittsburgh	.047		.44	Hancock	Pennsylvania

It is evident from Table 21 that there is an excess of meningitis even in those camps which have been unusually free from pneumonia and measles. Camp Dix has next to the lowest death rate of all the camps, namely, .19 per 1000. People of age group 20 to 29 in the state of Delaware show a rate for the past six months of .11 per 1000. The camp rate is nearly twice as great as a comparable civil community in this instance. Camp Devens has more than ten times the rate of certain New England States. Camp Lee has nearly ten times the rate of Virginia. Camp Funston has more than thirty times the rate of Colorado. Custer has three and a half times the rate of Michigan. Camps Wadsworth and Upton are seven times greater than New York City. Camp Hancock has nearly ten times the rate of Pittsburgh. If the rate for Louisiana is at all like that for Virginia, namely .14 per 1000, we find that Camp Beauregard's rate of 7.7 would be in the ratio of 55 to 1.

It seems quite evident that meningitis has been most prevalent in those camps whose soldiers come from areas in which this disease has been endemic. For some years meningitis has been widely scattered in South Carolina and adjoining states and it appeared in the families of the workmen engaged in building the barracks at Camp Jackson before the troops began to assemble and during the period covered by this report it was reported in many places in South Carolina. Meningitis has been endemic in Missouri and Kansas for some years and this accounts for its presence at Funston. Here also it appeared in the workmen and their families and in villages near Funston. We have no data concerning meningitis in the civil communities from which the soldiers at Beauregard came. The behavior of this disease is a strong argument for a reserve army and for culturing throats before the draft men leave their homes.

In the last three months some thirty or more localities in South Carolina have reported meningitis to the State Board of Health. During this time men from all parts of the State are being sent to Camp Jackson. It must happen that many of them from the infected localities are meningitis carriers. These are less likely to develop the disease than some of those with whom they come in contact. If the drafted men, especially those from the infected localities, were collected in small groups at or near their homes and held until cultures were made and no carriers sent to camp, in our opinion this disease would be greatly reduced among our soldiers. As it is, one carrier transmits this infection to others and in a short time there are many carriers.

SCARLET FEVER

Scarlet fever manifested itself for the most part in Camps Pike, Lewis, Kearny, Sherman, Dodge and Grant. The incidence at Pike stands out by itself, however, as is shown in Table 22. The rate at Pike is nearly twice that of the second camp in the table. Scarlet fever presents a most interesting problem for the student of community diseases, inasmuch as the rate in the National and Regular Army is three times that in the National Guard (See Table 8), whereas pneumonia and measles on the other hand showed an appreciable excess in the Guard.

The National Army rate is elevated mainly by the camps mentioned above. It is significant that southern camps, with the single exception of Pike, have been free from this disease. The camps most affected have been those containing troops from the Middle and Far West, Lewis, Kearny, Dodge, Grant, Custer. Meade, Dix and McClellan are also among the first ten of the table. Another point brought out by the table is that of the nine camps having the highest morbidity rates, eight are National Army camps. But one camp, namely, Kearny, is a Guard camp.

Just why scarlet fever should be distributed in the above manner it is very difficult to say. The primary difference between Guard and Nationals is in their housing, the former being quartered in tents, the latter in barracks. The nature of the quarters would not seem to be a factor, or we should expect some of the eastern and southern National Army camps to show scarlet fever, which they do not.

It seems most probable that this peculiar distribution is attributable to the presence of the disease in those particular localities from which these troops are

TABLE 22

SCARLET FEVER IN ARMY CAMPS
ANNUAL RATES PER 1000
Six Months' Period, September 29, 1917, to March 29, 1918

CAMP	ARMY	MORBIDITY RATE	DEATH RATE
Pike	N. A.	43.8	.44
Lewis	N. A.	25.1	.12
Kearny	N. G.	19.3	.0
Sherman	N. A.	17.3	.19
Dodge	N. A.	15.8	.0
Grant	N. A.	12.3	.23
Meade	N. A.	7.7	.07
Custer	N. A.	6.5	.20
Dix	N. A.	6.4	.09
McClellan	N. G.	3.7	.0
Doniphan	N. G.	3.6	.0
Funston	N. A.	3.6	.0
Cody	N. G.	2.4	.08
Taylor	N. A.	2.4	.0
Sevier	N. G.	1.9	.15
Sheridan	N. G.	1.8	.0
Hancock	N. G.	1.5	.06
Devens	N. A.	1.5	.0
Upton	N. A.	1.5	.0
Logan	N. G.	1.4	.0
Jackson	N. A.	.9	.0
Wadsworth	N. G.	.8	.0
Lee	N. A.	.8	.0
Bowie	N. G.	.6	.08
Shelby	N. G.	.6	.0
Travis	N. A.	.4	.0
Gordon	N. A.	.1	.0
Beauregard	N. G.	.0	.0
Wheeler	N. G.	.0	.0

drawn. This would account for the disease in both Kearny and Lewis, which contain men from the same general locality. The limitation of the disease among the National Army troops and its relative exclusion from the Guard, may possibly be explained by the later assembling of the Nationals, who brought scarlet fever into the camp after it had developed in the civilian communities. Furthermore, it may be pointed out that there are no Guard camps in the North. Therefore, the Guardsmen on mingling with the civilians in their vicinity were not brought into contact with the disease as frequently as the men from the camps located in the North. This explanation rests on the assumption that scarlet fever prevailed more extensively in the neighborhood of the northern camps than elsewhere. This fact is borne out by Table 23.

These data are very suggestive. Scarlet fever is seen to be much more prevalent in the middle and far West than in the South or East. It was highest in Montana, a State that contributed men to Camp Lewis. It was high in Michigan, Minnesota and Wisconsin which contributed men to Camps Grant and Custer. It was high in Delaware which sent men to Camp Dix. Camp Sherman's high position in the table is probably due to scarlet fever in Ohio. We do not have death rates for Ohio but from the morbidity statistics available, Ohio is seen to have a rate almost as high as the States of Michigan and Wisconsin. Records from the territory contributing to Pike are not available so that nothing can be said as to the influence of civilian diseases on the scarlet fever incidence at Pike.

TABLE 23

SCARLET FEVER IN CIVIL LIFE

ANNUAL DEATH RATES PER 100,000
Six Winter Months, 1917-1918

STATE	DEATH RATE	AVERAGE DEATH RATE FOR SECTION
Vermont	3.3	
Massachusetts	3.3	
Rhode Island	5.7	3.4
Connecticut	1.4	
New Jersey	2.5	
Delaware	6.5	4.5
Indiana	6.3	
Michigan	7.3	
Wisconsin	7.2	6.3
Minnesota	6.6	
Kansas	3.9	
Colorado	1.8	
Montana	24.6	13.2
Maryland	1.6	
Virginia	1.0	1.4
Kentucky	1.5	

DIFFERENCES IN THE BEHAVIOR OF MEASLES, PNEUMONIA, MENINGITIS, AND SCARLET FEVER

Certain differences in the characteristics of the diseases above mentioned are revealed in Chart XI, where there are plotted the morbidity rates for the National Guard and National Army Camps combined. The scale of the plot has been adjusted so as to bring the curves of each disease near together, otherwise there would be little opportunity for comparison, as the meningitis curve would scarcely appear at all if plotted to the scale for measles. These curves are designed to show the seasonal occurrence of the disease.

In the upper diagram there will be noted a surprising similarity between pneumonia and meningitis. Although pneumonia was about ten times as prevalent as meningitis, both diseases progressed at about the same rate and except for a period during December and January are parellel throughout the six months' period. In a sense their occurrence has been epidemic in nature as there is a distinct though blunt peak to the curves. The breadth of this peak extends from November to February with the greatest incidence during January and February.

The upper curves present a far different appearance from those of measles and scarlet fever. The measles curve is distinctly epidemic in character. It exhibits a sharp peak. The disease increased enormously during November and started to recede just as sharply. Then its rate of recession decreases and it flattens out very gradually reaching a level the first of March.

Scarlet fever acted differently from the other three diseases. Beginning in October it gradually ascended and did not reach its maximum height until fifteen weeks later. Aside from the fact of its gradual ascent, the scarlet fever curve resembles pneumonia and meningitis more closely than it does measles.

There are many factors which have governed the incidence of these various diseases. In these curves, measles stands out as a disease of distinctly epidemic character, a disease that is highly infectious and spreads rapidly. It is only

SEASONAL OCCURRENCE OF COMMUNICABLE DISEASE IN NATIONAL GUARD AND NATIONAL ARMY CAMPS

6 WINTER MONTHS, SEPT. 29, 1917 TO MAR. 29, 1918.

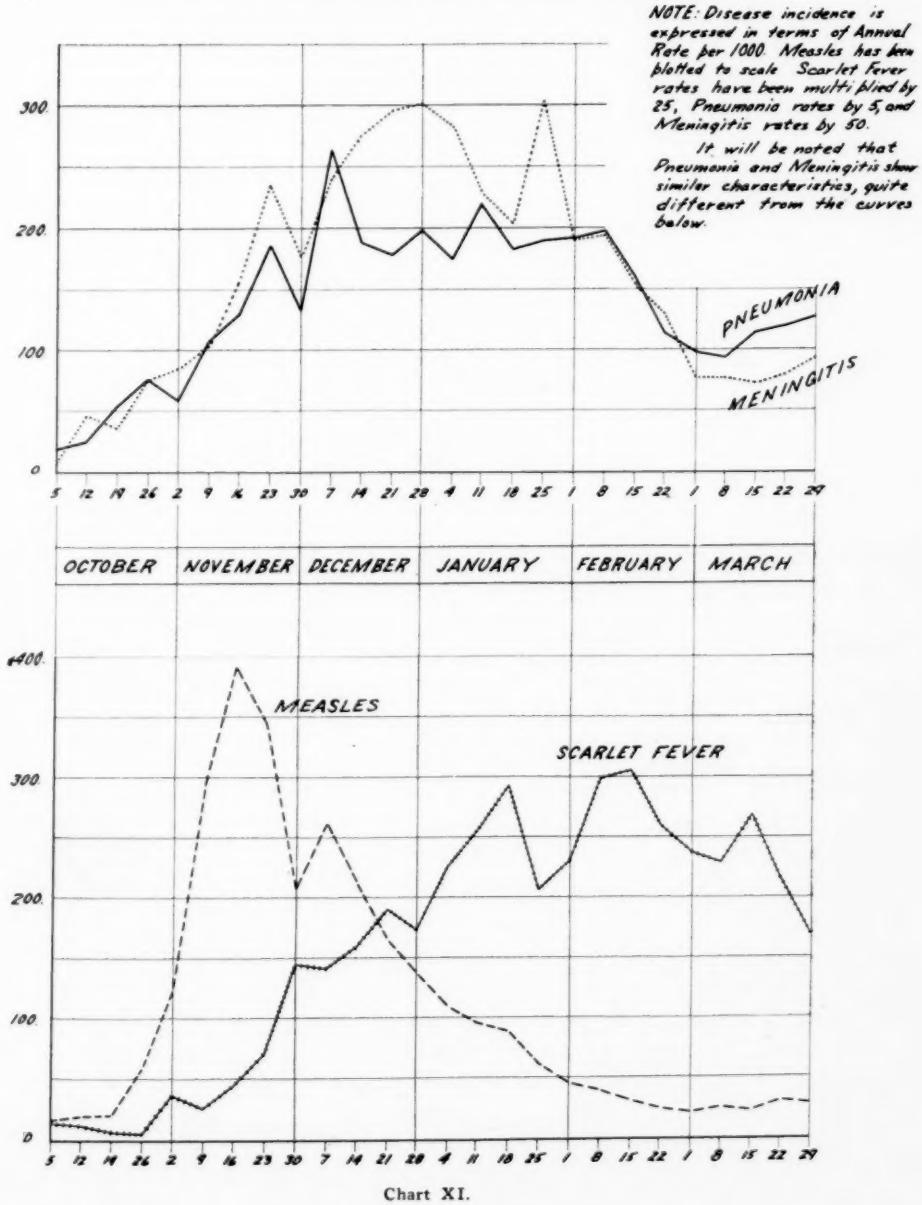

NOTE: Disease incidence is expressed in terms of Annual Rate per 1000. Measles has been plotted to scale. Scarlet Fever rates have been multiplied by 25, Pneumonia rates by 5, and Meningitis rates by 50.
It will be noted that Pneumonia and Meningitis show similar characteristics, quite different from the curves below.
PNEUMONIA
MENINGITIS
OCTOBER
NOVEMBER
DECEMBER
JANUARY
FEBRUARY
MARCH
MEASLES
SCARLET FEVER

Chart XI.

the susceptibles or those who have not had measles who are attacked. Upon exhausting the susceptible material the disease disappears. This fact will be appreciated when we recite the experience at Camp Wheeler. (See Chart XXI.) From an annual morbidity rate of 2200 for the week ending Nov. 16, the rate dropped to zero on Jan. 11th, and with the exception of a few cases during three

weeks in February and March, there has not been *a single case of measles* at Wheeler as late as June 28th.

This is a remarkable illustration of how a disease such as measles can literally take a census of every susceptible individual in the camp and when finished, die out completely for want of further sustenance.

With measles it matters not as to the condition of health. The disease progresses as the infection is spread amongst the susceptible population.

With pneumonia and meningitis it is different. Tests have shown that many people carry the germs of these diseases and yet possess good health. It is not until the vital resistance is lowered sufficiently by fatigue or exposure that the disease germs present become activated and pass through the body's protective gates which have been opened to them.

Scarlet fever resembles pneumonia and meningitis in the curves more so than it does measles. This was epidemic in a few camps but was far less prevalent and less widespread than measles. Every camp had measles, pneumonia and meningitis. There were no cases of scarlet fever reported at two camps and the morbidity rate was less than 1.0 per 1000 in nine camps.

From the statistical analysis before us scarlet fever is less infectious than measles, is less widely disseminated, and has less susceptibles among the population.

TYPHOID AND PARATYPHOID

Typhoid fever and its associated disease paratyphoid have been of slight consequence in the American army during the past winter. But three camps showed it to any extent and even here the incidence was very low. Camps Dix, Bowie, and Sheridan had annual morbidity rates per 1000 of 2.1, 1.4 and 0.9, respectively. These figures are relatively high as compared with the following rates for people at all ages:

Kansas	1.3
Virginia	1.1
Virginia	.73
Massachusetts	.31
Michigan	.29

As over against this, however, there were 12 camps that *did not have a single case* of typhoid or paratyphoid. Included in this list are Wadsworth, Wheeler, Cody, Doniphan, Shelby, Beauregard, Kearny, Jackson, Sherman, Custer, Grant and Pike. Comparative death rates for the army and people of all ages in civilian life during the six winter months of the past year are given in Table 24.

This result would be even more striking if the civilian rates were computed merely for the age period 20 to 29 years, in which age group typhoid is most prevalent.

It would be difficult to put forward testimony of a more striking nature as to the efficacy of the preventive measures now being utilized in the army against typhoid fever. To be sure, the past season has not been the typhoid part of the year and it is possible that the value of the typhoid prophylaxis will be more severely tested during the warmer weather and the fly season.

The American soldier today has found the army camp a safer place to dwell, so far as typhoid fever is concerned, than in the most favorably situated civilian community. Chart XII has been inserted to show the decline in the typhoid death rate in the American army since 1897.

ANNUAL DEATH RATE PER 100,000

TYPHOID FEVER

TABLE 24

TYPHOID AND PARATYPHOID IN ARMY AND CIVIL LIFE
ANNUAL DEATH RATE PER 100,000

PLACE	RATE
All troops in U. S.	1.3
National Army Camps (16)	2.3
National Guard Camps (13)	.6
Massachusetts	4.1
New York City	3.2
Vermont	4.4
St. Louis	5.2
Connecticut	6.4
Colorado	10.
Michigan	11.
Virginia	18.
Maryland	18.
Kansas	22.
Kentucky	28.
*Delaware	55.

*It is of passing interest that the National Army camp with the highest typhoid morbidity rate (Dix) is a mobilization point for Delaware troops.

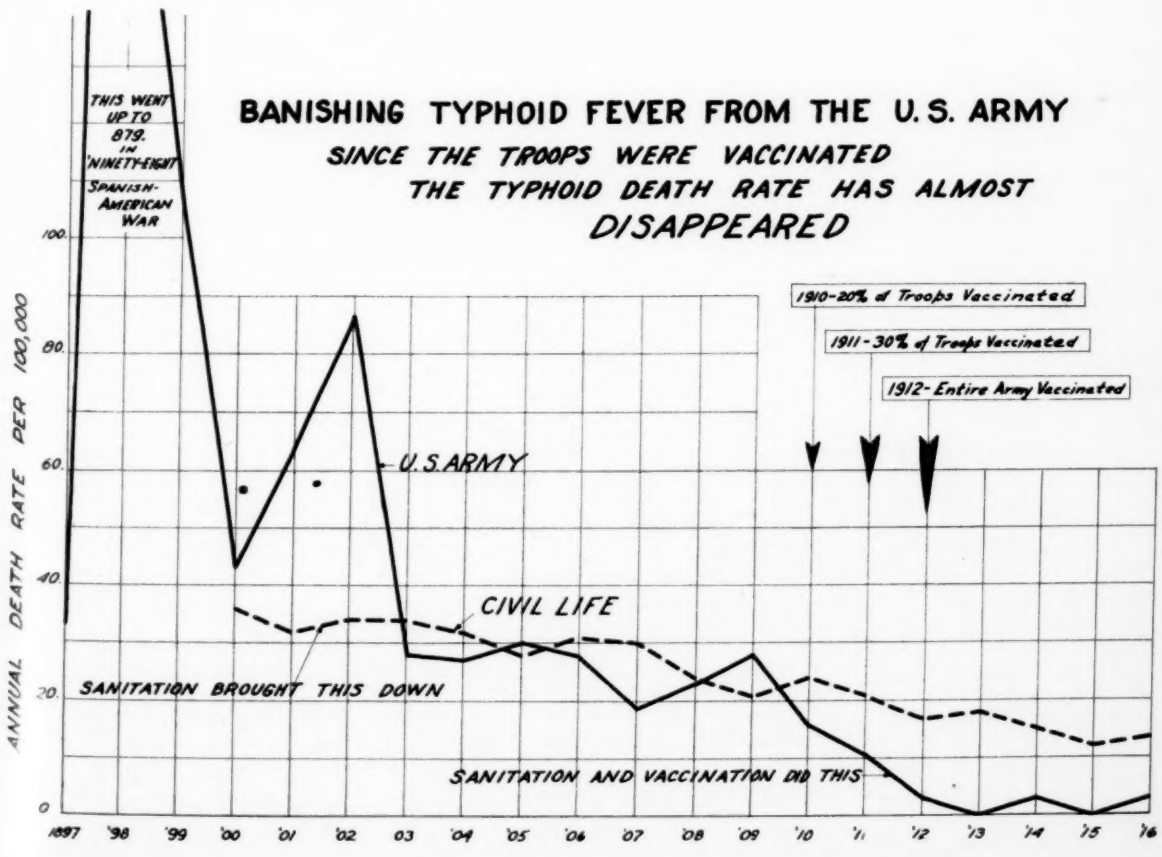

BANISHING TYPHOID FEVER FROM THE U.S. ARMY
SINCE THE TROOPS WERE VACCINATED
THE TYPHOID DEATH RATE HAS ALMOST
DISAPPEARED
THIS WENT UP TO 879. IN 'NINETY-EIGHT
SPANISH-AMERICAN WAR
1910-20% of Troops Vaccinated
1911-30% of Troops Vaccinated
1912-Entire Army Vaccinated
U.S. ARMY
CIVIL LIFE
SANITATION BROUGHT THIS DOWN
SANITATION AND VACCINATION DID THIS
ANNUAL DEATH RATE PER 100,000
0
20.
40.
60.
80.
100.
1897 '98 '99 '00 '01 '02 03 '04 '05 '06 '07 '08 '09 '10 '11 '12 '13 '14 '15 '16

Chart XII.

NOTE
Figures for Civil Life represent U.S. Registration Area

DIPHTHERIA

Deaths from diphtheria have occurred in only seven out of 29 camps, the rates for which are as follows:

(Annual Death Rate per 100,000)

Pike	30
Funston	22
Dodge	18
Cody	17
Custer	10
Doniphan	8
Logan	7

The death rate for diphtheria and croup in the U. S. Registration Area in 1915 for all ages was 15.7.

TUBERCULOSIS

As illustrated in an earlier table the tuberculosis death rate in the Army is much lower than in civil life, owing to the elimination of the tuberculous by physical examination. Many recruits with undetected tuberculosis passed into the Army, however, and the deaths of some of these occurred within the past six months.

The tuberculosis death rate for the Guard and the National camps is given in Table 25:

Table 25

Tuberculosis in Army Camps

Annual Death Rate per 100,000

CAMP	ARMY GROUP	RATE
Wheeler	N. G.	80
Pike	N. A.	44
Beauregard	N. G.	43
Wadsworth	N. G.	39
Sherman	N. A.	38
Lee	N. A.	32
Funston	N. A.	30
Kearny	N. A.	29
Upton	N. A.	27
Grant	N. A.	23
Jackson	N. A.	22
Gordon	N. A.	21
Custer	N. A.	20
Dix	N. A.	19
Sevier	N. G.	15
Dodge	N. A.	9
Sheridan	N. G.	9
McClellan	N. G.	8
Taylor	N. A.	8
Shelby	N. G.	8
Travis	N. A.	7
Hancock	N. G.	6
Lewis	N. A.	6
Logan	N. G.	0
Cody	N. G.	0
Doniphan	N. G.	0
Bowie	N. G.	0
Devens	N. A.	0
Meade	N. A.	0

EPIDEMIC BRONCHITIS

This disease has prevailed at all camps, but the only detailed report we have had is from the epidemiologist at Fort Oglethorpe. In view of the fact that this and allied ailments, which are looked upon as of minor significance, are so widespread and so common to all camps and are so largely responsible for hospital and quarters cases of a few days' duration, each, it is felt that a description of the situation as reported from Oglethorpe is of especial interest. Illnesses of this character have assumed added importance since they have come to be regarded as predisposing factors to such diseases as pneumonia and meningitis.

Bronchitis has been well-nigh universal in the Oglethorpe group of camps. Within ten days after their arrival newcomers have generally been attacked, the symptoms often being pronounced from the start. Sneezing and coughing are early signs. In the barracks, mess halls, lecture rooms and places of amusement, during November, December and January there was seldom a moment when coughing was not noticeable and continuous. It is estimated that 80 per cent of all the troops were affected. The epidemic abated in February with the advent of warm weather. Laboratory findings do not agree that any single organism has been the cause. Streptococci, staphylococci, influenza bacilli and other organisms found in the noses and throats of healthy people and sometimes associated with disease have been isolated, but not under circumstances which have led to any of these germs being demonstrated as the microbic cause of the bronchitis. The infectious matter has passed from person to person, probably in three ways: First, men have talked with one another at close range, permitting mouth germs to be projected directly into one another's faces. In the second place, there has been a general impregnation of the atmosphere in confined spaces. In the third place, articles handled by the infected have been transmitted to others. In these ways the amount of infectious matter which has passed from person to person must have been large and meeting a lowered resistance, the infection has rapidly spread.

Predisposing and contributing causes existed to some extent. The weather was unfavorable. Changes in the temperature were frequent and marked. The ground was cold, the air damp and the nights cold. Often men did not have dry shoes for weeks at a time. Some spent the entire winter in khaki. The men themselves were ignorant of simple personal precautions which might greatly have lessened their chances of infection. All of the severe cases have gone to the hospital. The universal prevalence is significant both on its own account, and because of the light which it throws upon the spread of other respiratory diseases in these camps. Although most persons regard bronchitis with comparative indifference, it is a disease of much significance. It is the common saying among the troops that the "bronchial cold" which attacks them soon after their arrival remains with them as long as they stay in camp. Its characteristic hard, explosive cough remains after other symptoms have disappeared. For the time it often unfits a man for duty and there are few sufferers whose efficiency has not been impaired by it. The bronchial pneumonias of these camps have been frequent sequelæ to bronchitis. Whether bronchitis renders a man especially susceptible to other acute respiratory diseases is a question of much interest. Like pneumonia one attack does not protect against others, but on the contrary

seems to predispose its victim to subsequent attacks. It is probable that bronchitis reduces resistance to measles, scarlet fever, pneumonia and other such diseases. The part which bronchitis may play in the spread of other respiratory infections gives reason for regarding it as a camp disease of the utmost importance. A carrier of meningitis may be relatively harmless so long as he is in good health, for then the germs which he harbors are fairly well locked up in his nose and in his throat, but when he experiences an attack of bronchitis he sneezes and coughs and at each paroxysm germs are shot into the air. Therefore, it is reasonable to suppose that measles, scarlet fever and other respiratory diseases have been spread by bronchitic soldiers. It may be asked if the exchange of bacteria from the nasal pharynx is so general, why is it that more sickness has not occurred. The answer probably is that most robust soldiers possess a fair degree of immunity acquired either by one attack as in the case of measles, or by frequent exposure without suffering from the disease.

The bronchitis which has prevailed in these camps may be designated as an acute infectious inflammation affecting in rapid succession downward the nasopharynx, the larynx, trachea, and first and second divisions of the bronchial mucosa. The symptoms are coryza, chilly sensations, hoarseness and soreness of throat, weakness, muscular soreness and slight fever (100 to 101 degrees). In severe cases the temperature may rise to 103 degrees with the correspondingly rapid pulse accompanied by substernal soreness and tightness of the chest. At first the cough was dry and unproductive. It frequently occurs in paroxyms causing muscular pain and soreness along the costal margin at the attachment of the diaphragm. On the third or fourth day, as a rule, the cough loosens and expectoration appears. At first it is scanty and mucous, later it is abundant and muco-purulent. Only negative results are obtained on palpation and percussion. On ausculation sibilant rales may be noted, except when resolution begins, when fine and coarse mucous rales are to be heard. The breath sounds are harsh. Bronchitis may be associated with other diseases such as measles, mumps or scarlet fever. When not complicated, recovery occurs at best within a week, although a chronic form may supervene and continue for months.

Although chronic bronchitis as seen in the quarantine camps is believed to be a definite entity, it is not always so diagnosed. Cough, elevation of temperature and muscular soreness accompany acute nasopharyngitis and tracheolaryngitis as frequently as bronchitis. A positive diagnosis of bronchitis is impossible unless harshness of breath sounds, sibilant and sonorous rales are audible, or in a stage of resolution, fine and coarse mucous rales are heard. Many cases are diagnosed as bronchitis from the symptoms alone.

Pneumonia is not frequently preceded by acute bronchitis, and acute bronchitis rarely terminates in pneumonia except when it accompanies measles. In measles there may be an extension to the terminal bronchi, and the inter-communicating air cells, under which circumstances bronchopneumonia develops.

INFLUENZA

Influenza, like bronchitis, has prevailed widely and we are indebted again to the epidemiologist at Oglethorpe for a description of this disease which undoubtedly describes the situation at many camps.

A disease strongly resembling influenza became prevalent in the Oglethorpe camps about March 18, 1918. It soon assumed endemic proportions. Within

two weeks every organization in Camp Forrest and the Reserve Officers' Training Camp was affected. It seems to have visited only a part of Camp Greenleaf. The War Prison barracks were not invaded. After about three weeks the epidemic subsided rapidly. The number of cases sent to hospital or to quarters was 1468 in a total strength of 28,586. Owing to the fact that many cases were not severe, the total number of officers and men attended can not be given; an estimate based on replies to a circular letter of inquiry to the several organizations, indicates that not less than 2,900 cases have occurred in Chickamauga Park.

The attention of the Camp Surgeon's Office was called to the existence of this disease on March 18th at which time the writer saw a number of men appear at sick call in the 51st Infantry, suffering with the disease which the regimental surgeons were unable to diagnose. The symptoms were as follows: Headache, pain in the bones and muscles, especially the muscles of the back, marked prostration, fever (sometimes as high as 104). Sometimes there was conjunctivitis, coryza, a rash and possibly nausea, recovery taking place in a few days.

In most cases a definite diagnosis was not made at the regimental sick call, but at the receiving ward, when a name was given, it was usually called influenza.

On April 3rd it was recommended that steps be taken to ascertain from the several organizations under the supervision of the camp surgeon and from other camps in the Oglethorpe region, the essential facts concerning the nature and epidemiological progress of the disease. A circular letter of inquiry upon these lines was sent out on April 4th to all organizations. Replies to this questionnaire indicated that the disease was first noticed in epidemic form on March 18th in the 51st Inf. In some organizations all cases were sent to hospital: in others their cases were treated in quarters or in the regimental infirmary. This does not mean that the disease was more severe in some organizations than in others. Difference in the disposition of the sick depended not so much upon the severity of the case as upon the local facilities for dealing with them. Records show that there were twice as many patients dealt with in quarters as in hospitals and there were probably twice as many cases existing as were carried on sick report.

The replies were unanimous in stating that the disease was not restricted to recruits nor to men who had already experienced or failed to experience an attack of measles, German measles, or scarlet fever. One attack did not protect against another.

In all the organizations the epidemic was first located in companies before it became general. In many instances a large proportion of the men were affected. According to the registrar of the Base Hospital, fully one-half of the total number of patients in the hospital had the disease. The rate at which the epidemic progressed made it impossible to trace its path, if indeed it followed any.

The incubation period was short, usually not over one or two days. Instances were found in which men isolated in quarantine were attacked apparently through contact with those who brought them food or approached them for other reasons. At the Post Hospital, a number of surgical cases in tents were infected, apparently by an orderly. In Co. B, of the 15th Machine Gun Battalion,

which was in quarantine on account of scarlet fever, nearly every one present was attacked. In Company A, 52d Infantry, a company which was quarantined, the men appeared to be protected by reason of their isolation.

Some organizations suffered more than others for no apparent reason. The 52d Infantry had the most and the 54th Infantry the fewest cases. In the 52d Infantry and the 15th Machine Gun Battalion, one in every seven of the officers and men were on sick report. In one ambulance company the proportion was one to six, while in others it ran as low as one to twenty-five.

The possibility that the disease which has just become epidemic has long existed in these camps in sporadic form, but has not hitherto attracted notice because of its infrequency, has received careful consideration. At first there seemed much to recommend this theory. Clinicians on the hospital staff claimed to have seen the disease at times since the summer of 1917. They say that it became rather prevalent in September. It is believed by some that the germ of influenza, like that of some other diseases, is constantly present in every large community; that it is not always virulent, but under certain conditions it acquires increased virulency.

If the organism which has caused the present epidemic has long been in existence in the Oglethorpe camps, it is not apparent why it has suddenly become so active. It would seem that the conditions for its epidemic prevalence have existed for a long time. Recent weather conditions, uncomfortable as they have been, have not been so disagreeable as they were in January. The theory that the explosion is of local origin needs a better explanation than can apparently be given it.

The weather was cloudy, damp and chilly. It was not cold nor wet, but the nights and especially the mornings were decidedly damp and uncomfortable. The difference between the air indoors and out was marked. Drafts were particularly noticeable.

Reviewing these facts about the weather, it can not be said with certainty that the conditions of temperature and humidity have had much to do with the epidemic, nor can it be denied that they played an important part in predisposing the troops to attack. Obviously the weather conditions have led the men to gather together indoors where they have been especially exposed to infection from one another, and it has had a chilling effect which is an important factor in the progress of all respiratory infections.

An inquiry was made to ascertain whether the troops were exposed to an unusual extent to the weather, to excessive fatigue, or in any other way before or after the epidemic started. This line of investigation brought no suggestive information to light.

No exceptional prevalence of influenza or other similar infectious disease has existed in Chattanooga or in the extra cantonment zone. An effort was made to shed light on the identity of the disease by studying the record of other cases of sickness which had been sent to the hospital under the designations of "fever, type undetermined" and "influenza" during the six months preceding the epidemic. These designations have never been definite; they have seldom been based on conclusive evidence at the hospital. Bacteriological examinations have seldom proved the influenza bacillus to be the causative agent of the cases

called "influenza." From time to time this bacillus had been found in the secretions of the nose and throat of troops, but has not been proved to be the cause in any large amount of sickness. "Fever, type undetermined" and "influenza" have been merely convenient expressions by which to designate cases of an indeterminate sort which demanded treatment and had to be called something.

Of a series of 161 cases of "fever, type undetermined" sent to the hospital before the present epidemic broke out, 59 turned out to be bronchitis and 41 pneumonia; 61 were called "influenza." In some instances "fever, type undetermined" had been found to be measles, scarlet fever, otitis media and meningitis. Out of 189 cases diagnosed "influena" at the regiments, 150 turned out at the hospital to be some other disease.

It is probable that the epidemic disease was recently brought to these camps. If it is genuine influenza, and the epidemiological features no less than the leading symptoms seem to point to that disease, there is here offered the most reasonable explanation of the outbreak which is now possible. No other disease spreads so fast or is so prostrating, considering its symptoms. Influenza may be nearly explosive in character. It spreads as rapidly as personal communication permits. Personal contact is intimate in the Oglethorpe camps, especially between men in companies and regiments. To some extent the regiments keep separate, but there is a general mixing at places of amusement in camp and Chattanooga. It is worthy of remark that the regular Officers' Training Camp is an organization which mingles but little with others in the Oglethorpe camps, and that here the epidemic was late in appearance. The same may be said of a part of Camp Greenleaf. The War Prison Camp is entirely separate and escaped infection. The epidemic seems to have burned out for want of suitable material, probably with the gradual but rapid decrease in virulence.

Reviewing the whole subject, it may be said that an epidemic of influenzal disease became prevalent in the Oglethorpe camps toward the latter part of March, 1918. The identity of the disease has not been positively determined after nearly a month of observation. It may have been an outburst of a form of sickness which has long existed in sporadic form in these camps. It may have been brought to the camps from outside. The weight of evidence is in favor of the latter theory.

It is a highly infectious disease with a short period of incubation. The weather has encouraged the epidemic, but is not apparently responsible. The disease is respiratory in type, with a strong resemblance to influenza in some of its most characteristic symptoms, as note the fever, pain in the back and legs and great prostration.

The cause of the rapid spread undoubtedly lies in the great infectivity of the causative agent, its short period of incubation and the intermingling of the troops. One thing seems clear, the disease could never spread unless the buccal or nasal discharge of the sick got into the mouths or noses of susceptible persons. The nature of the epidemic seems to show the extent to which this interchange takes place under the conditions which surround these troops.

ANALYSIS OF CAUSES OF DISEASE IN THE ARMY

In the preceding pages we have set forth the primary data of disease incidence in the army as a whole and for certain National Guard and National Army

camps. It has been pointed out that respiratory disease has prevailed to a much greater extent in the army than in civilian life. In the army 77 per cent of all deaths were caused by this group of six diseases during the period covered. In civilian life but 43 per cent of all deaths in a comparable age group are due to respiratory disease.

The most important of these six diseases is pneumonia in that about 80 per cent of the deaths from the respiratory group are attributable to this one cause. Meningitis is second in importance in being responsible for 15 per cent of the deaths in the respiratory group. This leaves but 5 per cent of the group to be accounted for by the four other diseases—tuberculosis, measles, scarlet fever and diphtheria.

Pneumonia and meningitis are important not only because they cause so many deaths, but because the excess of these two diseases over that in civil life is more pronounced than the excess of other diseases in the army over their extent in civil life. In the calculation made, meningitis was seen to be 45 times greater in the army, pneumonia 12 times greater. Measles was 19 times greater in the army but this is not of as great significance as the other two as the outcome is less fatal. Scarlet fever and diphtheria are only slightly more prevalent in the army than in civil life. It is the underlying cause of this excess disease incidence in army camps that we are particularly interested to discover.

We have noted that there is a wide variance in the rates at the different camps and although the average for all troops is raised by excessive rates in a few camps, the majority of the camps still have rates appreciably above the rate for civil life. Certain influences seem to be acting on all camps and certain other influences are confined to a certain group of camps. We may classify these influences under three main heads. The prevalence of disease may be attributed to one or more of these causes:

1. Weakening of the resistance of the soldier due to
   (a) Exposure to severe weather.
   (b) Insufficient clothing.
   (c) Inadequate housing, lack of heat.
   (d) Fatigue.
2. Unusual facilities for the transmission of the infective agent by—
   (a) Close contact with carrier cases.
   (b) Undetected cases among new recruits.
   (c) Importation of mildly sick men and carriers from other camps.
   (d) Association with civilian community.
   (e) Overcrowded quarters.
   (f) Inadequate hospital care of patients.
   (g) Unsanitary conditions in general.
3. Natural susceptibility to disease.
   (a) Racial influence.
   (b) Effect of rural life.
   (c) Climatic influence.

1. INFLUENCE OF THOSE FACTORS WHICH BRING ON PHYSICAL DEBILITY

Under this heading we may consider the influence of those factors which lower the physical tone of the body and make the natural defenses of the body less resistant. The recruit fresh from civilian life undergoes a considerable change in his mode of living on entering camp. There he becomes a part of a vast machine. He has less opportunity to cater to his personal wants. He is out of doors more. He is apt to become chilled or wet. He sleeps in colder quarters, and not only sleeps but lives,, eats, undresses and dresses, bathes, etc., in colder quarters. Being out of doors more his appetite is greater. He eats more heartily. He is inclined to overeat. In his desire to get ahead in competition with his associates he is apt to work harder, to become unduly fatigued. When indoors, in an effort to keep warm, he joins the crowd about the stove. He may be subjected at times to overheated atmospheres.

Each and all of these influences tend to pull down the physical resistance of the recruit. They put a strain upon him *and especially so upon the man who hasn't been used to this sort of thing.* It is the untrained individual who feels the rigors of camp life most keenly.

With a realization of this state of things we may consider to what extent these factors have acted at the different camps. First we are confronted with the facts so strikingly illustrated in the charts, namely—

The morbidity rate from pneumonia is *greatest* in Camps: Bowie, Wheeler, Travis, Pike and Cody.

The death rate from all causes is *greatest* in Camps: Pike, Wheeler, Beauregard, Bowie and Jackson.

The morbidity rate from meningitis is *greatest* in Camps: Jackson, Beauregard, Funston, Doniphan and Bowie.

The morbidity rate from measles is *greatest* in Camps: Pike, Bowie, Wheeler, Sevier and Beauregard.

The death rates from all causes are *lowest* at Camps: Sheridan, Hancock, Wadsworth, McClellan and Logan.

The morbidity rates from pneumonia are *lowest* at Camps: Sheridan, Wadsworth, Dix, Custer and Hancock.

The morbidity rates from meningitis are *lowest* at Camps: Wadsworth, Logan, Devens, Dix and Upton.

The morbidity rates from measles are *lowest* at Camps: Dix, Lewis, Hancock, Wadsworth and Upton.

In the face of the above we should expect, that if exposure were a factor in increased disease incidence, that the exposure was the same at each of the camps where disease was prevalent, and that this exposure was entirely different from that at the camps where disease was rare. We may examine this point further.

(a) *Weather.*—The weather of the past winter has been unique in some respects. East of the Rocky Mountains, the temperature in general has been the coldest in 46 years. West of the Rockies it has been the warmest in 46 years.

At Macon, Ga., October, 1917, was the third coldest October and January, 1918, was the coldest January in 46 years. January was an unusually cold month at San Antonio, Texas. October, 1917, was the coldest and January, 1918, the

third coldest in Chicago for 46 years. December, 1917, and January, 1918, were the coldest New York City has seen for 46 years.

At Los Angeles, Cal., the year 1917 witnessed the warmest December in 40 years and this holds true for Walla Walla, Washington. Weather data are reported graphically in Chart XIII.

If the low temperature had been a prime factor in the cause of disease we should expect the northern camps to suffer most, the southern camps next and

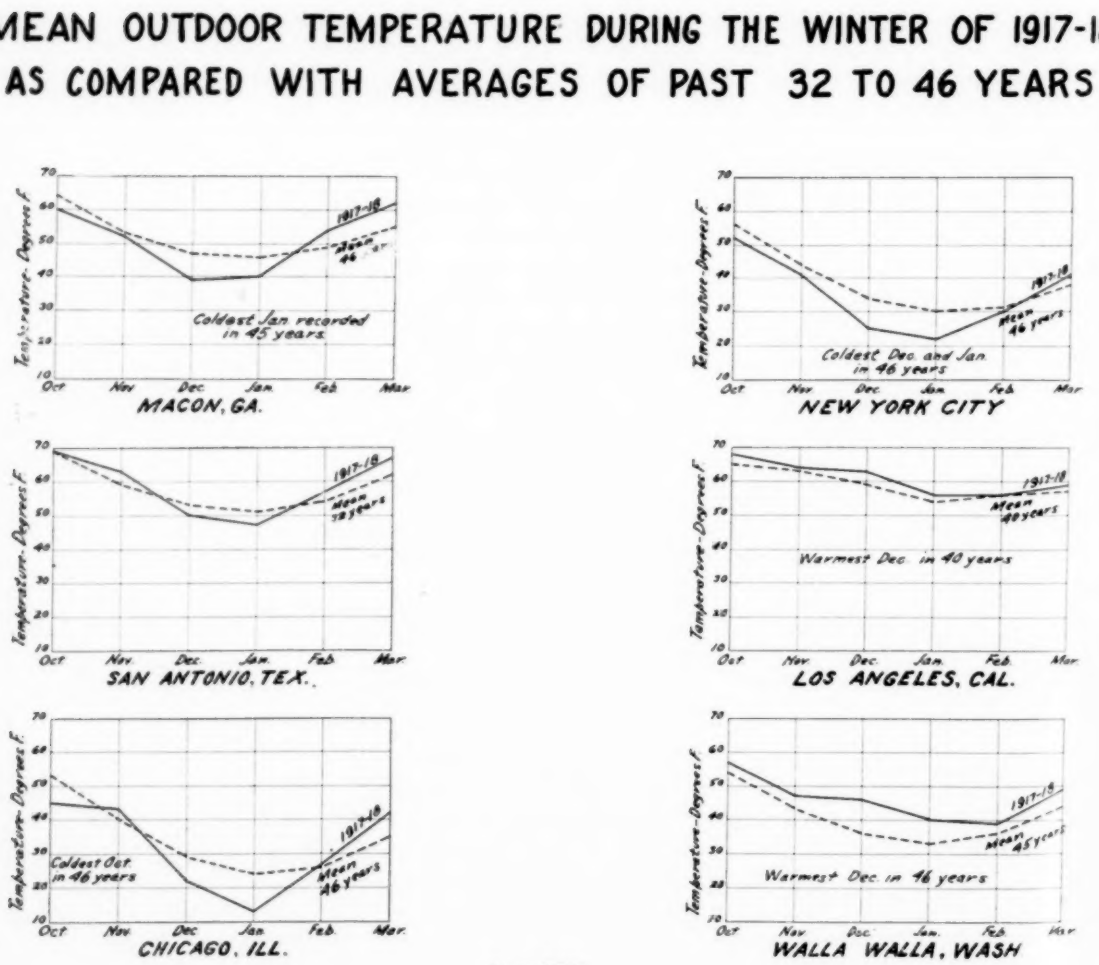

MEAN OUTDOOR TEMPERATURE DURING THE WINTER OF 1917-18
AS COMPARED WITH AVERAGES OF PAST 32 TO 46 YEARS
Temperature-Degrees F.
Oct. Nov. Dec. Jan. Feb. Mar.
1917-18
Mean 46 yrs.
Coldest Jan. recorded in 45 years
MACON, GA.
Coldest Dec. and Jan. in 46 years
Mean 46 years
NEW YORK CITY
Mean 38 years
SAN ANTONIO, TEX.
Mean 40 years
Warmest Dec. in 40 years
LOS ANGELES, CAL.
Coldest Oct. in 46 years
Mean 46 years
CHICAGO, ILL.
Mean 45 years
Warmest Dec. in 46 years
WALLA WALLA, WASH

Chart XIII.

the far western camps, Kearny and Lewis where the weather was warmer than usual, least. This is not the case by any means. Camps Devens and Upton are probably the coldest camps and yet their disease incidence has been among the lowest.

The possibility for undue exposure to weather and its consequences is suggested in the reports from Camp Travis. Speaking of pneumonia a report reads that "the majority of the patients stated that their colds commenced after being chilled while on guard or at drill or when cold during the night and

that these colds commenced at or about the dates of 'Northers' and a sudden drop of temperature. The exposure and chilling is rather significant as a predisposing cause of pneumonia in this camp. It will be noted that no cases occurred in the Quartermaster Corps, Ordnance Corps, Base Hospital personnel, Bakers' Company, and the Bakers' and Cooks' School. Neither have any of the 1758 officers of this camp had pneumonia. These organizations are not required to do drill or guard duty. Their duty is mostly indoors, while other organizations are exposed to the cold, wind and dust. With the exception of the above named organizations, pneumonia is widely distributed throughout the camp."

Reports from Camp Beauregard state that there was a direct relation between the epidemic of pneumonia and the severity of the weather, the epidemic subsiding with improvement of the weather.

Severe weather undoubtedly caused trouble in some camps but this was not the controlling factor by any means.

Camps Bowie, Beauregard and Logan experienced about the same climatic conditions. The annual pneumonia morbidity rates per thousand for the first two were 96. and 42. respectively. That for Logan was 16.

Camp Pike is in about the same latitude as Camp McClellan. The pneumonia rate for the former is 63., that for the latter 9.6.

Camp Wheeler and Camp Sheridan faced the same weather. The pneumonia rate for Wheeler was 95., that for Sheridan 9.3.

Camp Jackson is close to Camps Wadsworth and Hancock. The former is high in the disease table, the latter low.

We are aware of the fact that we are leaving this question of the relation of the weather to the acute respiratory diseases and especially to pneumonia in a very unsatisfactory state. There are strong reasons for believing that the incidence of pneumonia is greatly influenced by weather conditions. Curves showing weather conditions as influencing pneumonia, in some of the camps, are striking and this evidence comes from camps as far apart as Sevier and Upton. We hope that more attention will be given to this matter in future studies on the epidemiology of pneumonia.

(b) *Insufficient clothing.*—Associated with the question of weather severity is that of inadequate clothing. The severity of the winter is felt less if the men are provided with plenty of warm clothing. There are a number of instances where the lack of winter clothing was felt, specific mention of this being made at Camps Sevier, Wheeler, Logan, Bowie, Sheridan, Shelby, Beauregard, Kearny, Devens, Dix, Lee, Jackson, Custer, Pike, Dodge, Funston and Travis. This factor without doubt increased colds which may in turn have led to pneumonia. For instance at Camp Jackson as late as January it was reported that "many men * * * * are seen going about in cotton clothing, despite freezing weather." At Pike we note the following from the report of an inspector: "The clothing of all the men in November and December according to the records was not complete. Many men were undoubtedly exposed to changes in temperature which caused a lowering of their resistance thereby making the spread of infectious diseases much easier."

The onset of measles and pneumonia at Camp Sevier was attributed to

exposure to weather and lack of clothing. The report reads—"During the latter part of October a sudden drop in temperature occurred causing considerable discomfort of the troops, many of whom were poorly clad. It was at this time a large increment of draft men was received. Many of these recruits had been exposed to measles; they were poorly nourished. The sudden exposure of these troops in this condition resulted in many cases of pneumonia, many deaths occurring."

Judging from this, Jackson, Pike and Sevier suffered from lack of clothing. These camps have high disease incidence. But clothing shortage was by no means peculiar to those camps with high disease incidence. Referring to the previous list we note that Logan, Sheridan, Devens and Dix are also included and yet these camps had relatively little sickness. In November at Sheridan "few men had woolen underclothing or overcoats" and men could not sleep at night because the two blankets provided were insufficient to keep them warm. At Devens as late as December we learn from the report of inspectors that the clothing of men was insufficient and that "there is much suffering from cold and many cases of frozen ears and fingers are incurred by men on duty in weather below zero without winter gloves and ear protectors."

Lack of clothing was a contributing factor in disease incidence but it is not believed that this cause was responsible for the peculiar distribution of diseases in the different camps.

(c) *Inadequate housing and lack of heat.*—In addition to lack of warm clothing there was also felt the lack of warm quarters. It is aggravating and debilitating to be cold when out of doors at work, but it is even more serious when there is no opportunity to retire for a time to warm quarters. In some instances lack of fuel made it impossible for men to keep warm indoors during day and night. But here again there is no evidence that Pike, Beauregard, Wheeler and similar camps suffered more from this cause than Logan, Wadsworth, Devens or Upton. If anything, the northern camps would suffer more in this respect and yet the northern camps had less disease. Similarly if lack of fuel and cold quarters were a controlling factor we should expect the National Guard camps to show more disease because of their tent quarters, but this is not the case.

(d) *Fatigue.*—It is well known that overwork leading to excessive fatigue lessens resistance to disease. In view of the previous life of many recruits who have come from offices and factories, it is probable that the vigorous outdoor life of the camp introduced suddenly pulled down the general body resistance. Here again, however, we must point out that the records at hand do not show that fatigue was any more of a factor at Pike, Beauregard, Bowie and allied camps than at Logan, Devens, Sheridan and others of this type.

The report from Wheeler is that "fatigue has not been a factor" in disease incidence. From Wadsworth we are informed that "fatigue has been a contributing factor in the etiology of respiratory diseases, but a very minor one." Essentially the same conclusions are obtained from those familiar with the situation at Lee and Lewis.

The Division Sanitary Inspector at Travis believes "that men upon entering military service are subjected to a too strenuous program of drills for the first four weeks. It would be better if the first four weeks of military service were

given over to light exercise and short periods of drill which could be slowly increased. This would give the men a chance to better accommodate themselves to the new life and the body a chance to build up physical resistance against disease."

In general fatigue has evidently made troops somewhat more susceptible to disease, but this has been a general tendency and not one peculiar to any particular group of camps.

2. INFLUENCE ON DISEASE INCIDENCE OF THE UNUSUAL FACILITIES FOR THE TRANSMISSION OF THE INFECTIVE AGENT, AFFORDED BY CAMP LIFE

(a) *Close contact with carrier cases.*—The bringing together of men from all sections into camps naturally increases the possibility of contact transmission of disease. It will be readily appreciated that a carrier of the meningococcus can do more damage in an army camp of 30,000 than he could on a farm where his association is limited to few individuals. The prevalence of sickness in the various camps has without question been augmented by the presence of individuals who are themselves well but who carry in their noses and throats the germs of the respiratory diseases, but there is no reason for believing that the number of such carrier cases is so much greater among the men of Camps Pike, Beauregard, Wheeler, Bowie, Jackson than among the men of Camps Logan, Hancock, Sheridan, Wadsworth or McClellan. In other words there is no indication that the germs of respiratory disease are any more widespread to begin with in the former camps than the latter. This probably is not true of meningitis. It is certain that the areas from which Jackson and Funston drew men are those in which this disease has been endemic.

To check up this point we need statistics on the number of carriers among the civilian population in these various districts and this material is lacking.

The importance of the carrier is a mooted question. In view of the great number of carriers of certain diseases which have been discovered it is a question whether or not it is practicable to even attempt their detection and eradication. It seems more likely that immunity or physical resistance is more potent a protective force than efforts toward keeping away from the germ itself.

There were found at Camp Travis, during January, 112 positive meningococcus throats among 3,159 men examined. This amounts to 3.5 per cent of positive carriers. This number of carriers in one month is nearly three times the number of actual cases of meningitis reported from Travis for the entire six months.

At Camp Jackson 8 per cent of all hospital admissions were found to have positive meningococcic throats. As this is a higher percentage than is found among the population at large, it is believed by the epidemiologist at Jackson that a lowering of the physical tone renders one more receptive to the meningococcus.

At Camp Bowie, during February, seven cases developed among 114 carriers. If the persons coming in contact with this number of carriers had not possessed some immunity to this disease the cases would have been much more numerous.

It is reported from Camp Grant that diphtheria carriers accumulated there at one time to the number of one hundred. They were quartered at the Base Hospital while continued unsuccessful efforts were made to clear up their throats. Finally in desperation almost all of these men were turned loose and returned to duty with their companies and no increase in diphtheria occurred as a result.

VENEREAL DISEASE IN THE THREE GROUPS OF THE U.S. ARMY

WEEKLY INCIDENCE EXPRESSED IN TERMS OF ANNUAL CASE RATE PER 1000

SEPT. 1917 TO MAR. 1918 INCL.

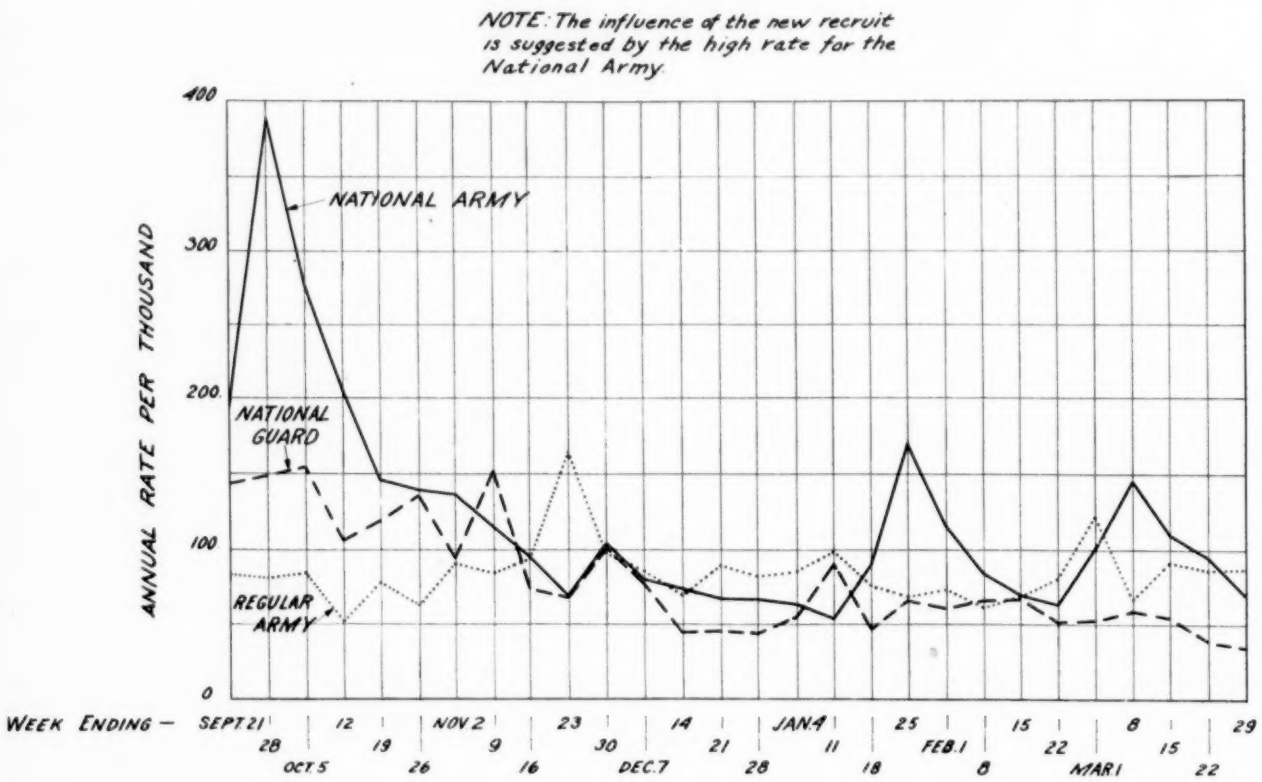

NOTE: The influence of the new recruit is suggested by the high rate for the National Army.
ANNUAL RATE PER THOUSAND
400
300
200
100
0
NATIONAL ARMY
NATIONAL GUARD
REGULAR ARMY
WEEK ENDING — SEPT. 21 28 OCT. 5 12 19 26 NOV. 2 9 16 23 30 DEC. 7 14 21 28 JAN. 4 11 18 25 FEB. 1 8 15 22 MAR. 1 8 15 22 29

Chart XIV.

(b) *Undetected cases among new recruits.*—In a sense this matter has already been covered in the previous discussion. There is a new problem introduced here, however, in that men fresh from civilian life are likely to act as foci of infection.

Pneumonia, measles and meningitis are to be found widely spread over a state. There is scarcely a county wholly free from these diseases at any one time. The gathering of the drafted men brings in many who are either coming down with the disease or who are carriers.

Reports from Wadsworth state that "new troops shortly after arriving in this camp generally showed quite a large number of sore throats. These would disappear after the troops had been in camp for several weeks."

Reference has already been made to the onset of measles and pneumonia at Sevier coincident with the coming of new draft men. Sevier "was practically free of all communicable diseases until the influx of the draft men from Camp Jackson; our first measles case appeared at this time, in the early part of October. Scarlet fever did not appear in this camp until troops arrived from Jefferson Barracks, Missouri."

The Division Surgeon at Camp Wheeler in a published report describing the epidemic of measles and pneumonia there, states that "draft men brought measles on every train." "Six cases were taken from one train."

This is especially noticeable in the case of venereal disease. The admission rate from this cause went up enormously in the National Army with the accession of new men. As time went on this fell off until the rate was no higher than that for the Guard or Regular Army.

This fact is graphically shown in Chart XIV.

New men increase disease in camp but this cause should act no differently in one part of the country than another.

(c) *Importation of mildly sick men and carriers from other camps.*—More striking than the association of disease with new recruits has been the association with importations from other camps. There has apparently been an endeavor on the part of some to weed out the undesirables and ship them along when the call for transfer has come. This has been complained of at many camps and that there are just grounds for this complaint is evidenced by the many instances of sick men being found among troop arrivals. This is an influence which would react differently on the camps. Thus, if one camp is gradually being recruited in strength and not shipping men away it may at the same time accumulate an abnormal proportion of physical weaklings. Or a camp may act as a mobilization center both receiving and shipping troops. If there are sick men among the arrivals these are filtered out and an undue accumulation of hospital admissions will take place sending the rate up above that of a relatively closed camp. It is felt that Funston and Dodge have suffered notably in this respect.

An examination of how this works may be taken from the experience at Camp Sheridan occupied almost entirely by Ohio National Guardsmen. In April a contingent of over 700 men was received from Camp Travis. Immediately on detraining a physical examination of this group was made and revealed the following:

Venereal disease	40 cases
Mumps	3 "
Measles	8 "
Pneumonia	2 "
Meningitis carriers	27 "
Trachoma	2 "

These cases should have been discovered before this contingent left Texas and the infected persons isolated from the rest. By reason of the failure to do this the infection spread while in transit and there appeared shortly after in addition to the cases examined on detraining the following:

Venereal disease	8 cases
Mumps	37 "
Measles	6 "
Diphtheria	2 "
Pneumonia	8 "
Meningitis carriers	40 "

Camp Beauregard, speaking of the meningitis and measles there, states, that the epidemic started with the arrival of troops from Camp Pike and the State mobilization camp of Mississippi.

Camp Pike on the other hand transmits the blame to other camps—"A study of the character of material received from other camps shows that in many instances physical derelicts were sent to Camp Pike." Contributing to Pike were troops from Custer, Funston, Grant, Sherman, Taylor and Dodge.

Reports from Camp Wadsworth state that "among those troops received from Camps Taylor, McClellan and Fort Oglethorpe, one case of meningitis and one case of measles were taken from the train on which the troops arrived."

Speaking of the new increments from Camp Taylor this report goes on to say that the noneffective rate for this new group went up to about 79 per 1,000 whereas the noneffective rate for the division previously was around 24.

Introduction of scarlet fever, measles and mumps are all attributed to importation of men from other camps by the epidemiologist at Camp Upton. These diseases were present among a small increment from Camp Dodge. On distributing these men about the camp these diseases began to appear in those organizations to which they had been assigned.

Camp Cody attributes the entrance of epidemic disease to new accessions. Thus "measles and German measles . . . followed shortly after the arrival of troops from Camp Dodge."

The epidemiologist at Custer reports that many of the new arrivals entered camp suffering from acute respiratory infections or promptly developed them. "The succeeding incidence of pneumonia was principally among the unseasoned troops."

(d) *Infection from the surrounding civilian community.*—Disease has been introduced into camps from the civilian community. This may occur in camps long established and among troops who have been in the service for some time.

Data from Camp Upton is interesting in this connection. Five cases of measles occurred in the 304th Field Artillery. The first man had been home in Philadelphia two weeks previous. The second man had been home in Sussex, N. J., 16 days previous to his admission to the hospital. The third man sent to the hospital on April 16th had been home in Olean, N. Y., from April 3rd to

6th. Data is incomplete in the other two cases. This evidence points to infection from civil life.

The epidemiologist at Camp Beauregard states that meningitis was prevalent in the civilian community around the camp and was responsible for its introduction into the camp. This was also true for measles.

Transmission of scarlet fever in this manner has been discussed at length on page 669.

(e) *Overcrowding.*—The early mobilization of the National Guard troops resulted in a great amount of overcrowding. There are instances of ten or more men to a tent that accommodates comfortably not more than five or six. This herding together of the men permitted unusual opportunity for transmission of the disease from one person to the other by contact, sneezing and coughing, and infected dust.

Specific instructions were issued to provide quarters which would give each soldier at least 500 cubic feet of air space. Just how serious this crowding was as a factor in spreading disease is a question. That it was responsible to a certain degree there is little doubt, but it is a very significant fact that there were remarkably few instances of more than one case of pneumonia or meningitis in the same tent. If this unusually intimate association of the men had been a controlling factor we would expect not one but four, six and eight cases to a tent.

In this connection it must be pointed out also that overcrowding occurred in those camps with little disease incidence as well as in those with high disease incidence. Crowding was by no means confined to the camps with excessive sickness.

A special inspection made at Camp Wadsworth in January showed instances of 9 men to a tent. There should not have been more than five in order to allow 50 square feet of floor space per person. This camp had a relatively low disease incidence.

Camp Logan had but 28 square feet of floor space per person for a long while. Camp Lee had as many as 15 men to a tent as late as November. Excessive sickness in certain of the southern camps can not be charged to this cause.

On the other hand, while crowding is not a controlling factor, it has been undoubtedly an incidental factor as evidenced by the difference in disease incidence between officers and men, the latter being brought into much more intimate contact with each other than the former. (See Table 26.)

In morbidity from measles the enlisted men exceeded the officers by appreciable proportions in every one of the 11 camps. Pneumonia morbidity has been greater among the men in 9 camps. Meningitis and scarlet fever were more prevalent among the men in all except one instance, meningitis at Beauregard being greater among officers. Deaths from these diseases were so few among the officers as to make any comparison of rates uncertain. Accepting the figures as they are, however, we find that deaths among the men were greater in 27 out of 44 cases.

It is of interest to note that at Wadsworth, Grant, Custer, Meade and Travis the excess of measles was about 2 or 3 times greater among the men. At Pike, Beauregard, Lee and Jackson the ratio is nearer 10 to 1. It would appear

TABLE 26

COMPARATIVE MORBIDITY AND MORTALITY AMONG OFFICERS AND ENLISTED MEN SIX MONTHS, SEPTEMBER 29, 1917, TO MARCH 29, 1918

FIGURES IN ANNUAL RATE PER 1000

	MEASLES				*PNEUMONIA*			
	CASES		DEATHS		CASES		DEATHS	
CAMP	OFFICERS	MEN	OFFICERS	MEN	OFFICERS	MEN	OFFICERS	MEN
Wadsworth	2.2	7.9	.0	.0	4.3	9.1	2.2	1.1
Dix	4.8	34.	.0	.0	9.5	8.0	3.6	1.5
Grant	20.	50.	.0	.08	4.	14.	2.0	1.5
Custer	21.	65.	.0	.49	8.2	7.0	2.7	1.5
Meade	25.	36.	1.1	.0	3.2	18.	2.2	2.6
Lee	5.9	85.	.0	.19	18.	24.	9.8	5.5
Gordon	33.	168.	.0	.21	4.	15.	1.3	5.3
Jackson	36.	230.	.0	.33	5.9	36.	.0	11.
Travis	66.	*124.	.0	.0	7.1	78.	1.2	11.
Pike	35.	390.	.0	.15	32.	63.	1.3	25.
Beauregard	28.	256.	.0	.11	21.	42.	.0	15.

	MENINGITIS				*SCARLET FEVER*			
	CASES		DEATHS		CASES		DEATHS	
CAMP	OFFICERS	MEN	OFFICERS	MEN	OFFICERS	MEN	OFFICERS	MEN
Wadsworth	.0	.8	.0	.20	.0	.8	.0	.0
Dix	.0	.6	.0	.19	2.4	6.4	.0	.09
Grant	1.0	1.3	1.0	.31	6.0	12.	.0	.23
Custer	.0	1.8	.0	.30	.0	6.5	.0	.20
Meade	1.1	2.4	.0	.66	4.2	7.7	.0	.07
Lee	2.0	2.7	2.0	1.2	.0	.8	.0	.0
Gordon	1.3	3.6	.0	.96	.0	.1	.0	.0
Jackson	5.9	26.	1.2	7.5	.0	.9	.0	.0
Travis	1.2	2.7	1.2	2.5	.0	.4	.0	.0
Pike	.0	3.8	.0	2.4	7.9	44.6	.0	.44
Beauregard	28.	12.8	19.	7.7	.0	.0	.0	.0

*Many cases not reported.

from this that the men at the latter camps are much more susceptible to the disease. There is no such big divergence between officers and men for pneumonia. Meningitis shows still less difference between officers and men. Scarlet fever is somewhat too irregular to summarize. One interpretation offered for the peculiar characteristics of the first three diseases is that measles is much more readily transmitted and that susceptibility to this is quite general among certain troops. Pneumonia and meningitis, especially the latter, are less readily spread by contact and susceptibility is not at all general.

It must also be pointed out that what holds true for the enlisted men is likewise true for the officers so far as distribution of disease at the various camps is concerned. Wadsworth has the lowest measles incidence among both officers and men. Pike has the highest incidence among the men and one of the highest rates for officers. In general this holds true for the other camps. Those camps with high disease incidence among the men likewise have high disease incidence among officers.

(f) *Inadequate Hospital Care.*—An effort has been made to determine whether lack of hospital accommodations has caused an excess of disease in any one camp. It is believed that this has acted to a certain degree, there having been a few instances of contact transmission within the wards. This has been corrected by more complete isolation of cases. Some camps have suffered more in this respect than others, but this has been a relatively slight factor in the general dissemination of disease. Lack of hospital facilities would seem to ac-

count for the excess of disease at Bowie over Travis, both camps receiving men from the same states. Bowie was cramped for hospital room and cases could not be handled as carefully as at Travis where the accommodations were more ample. With such facilities Travis was able to send incipient respiratory infections to the hospital and thus prevent their progress into more serious illness. Bowie could not do this and had partly in consequence nearly twice as many deaths from pneumonia. This result is illustrated in Chart XV. In Chart XVI is shown the apparent universal influence which treatment of the minor diseases has on the death rate from pneumonia.

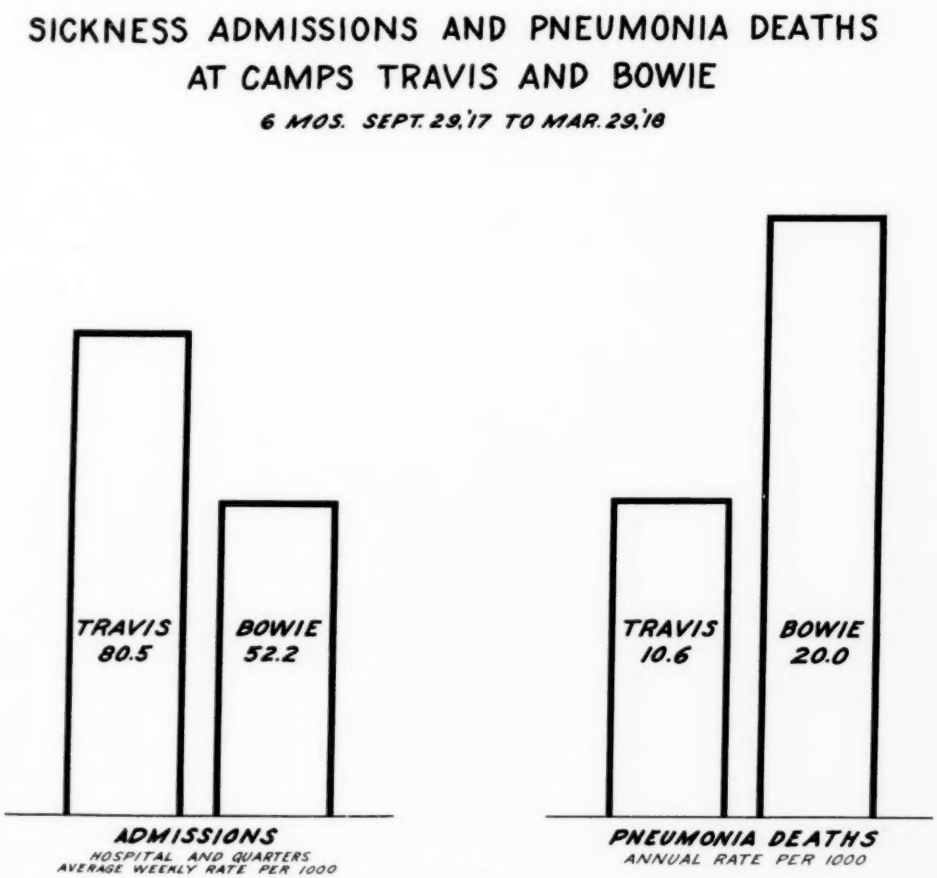


Chart XV.

Faulty quarantine at some camps is believed to have been a factor in disease transmission. Quarantine can be kept in spirit or only literally. There are a number of instances where little else was done than to issue the order. There was no following up of the order nor any serious attempt to abide by it.

(g) *Unsanitary Conditions in General.*—Respiratory disease is affected by general or personal sanitation. Inasmuch as the infective agents gain access to the body through the mouth and nose it is important to observe those matters of personal hygiene such as the avoidance of promiscuous spitting, of trading pipes and mess utensils, washing the hands before meals, etc. Evidence along

these lines is not exact or complete, but the observation has been made that in certain of these camps with high disease incidence, the men are in general more careless of their personal habits. They are not as cleanly. Spitting outdoors and indoors is of the most promiscuous character. Food is less carefully prepared and its choice is a matter of less concern than in other camps. Promiscuous and well nigh universal spitting on the streets, about and in tents, on parade grounds, etc., has been reported at Bowie. Pneumococci have been found in dust.

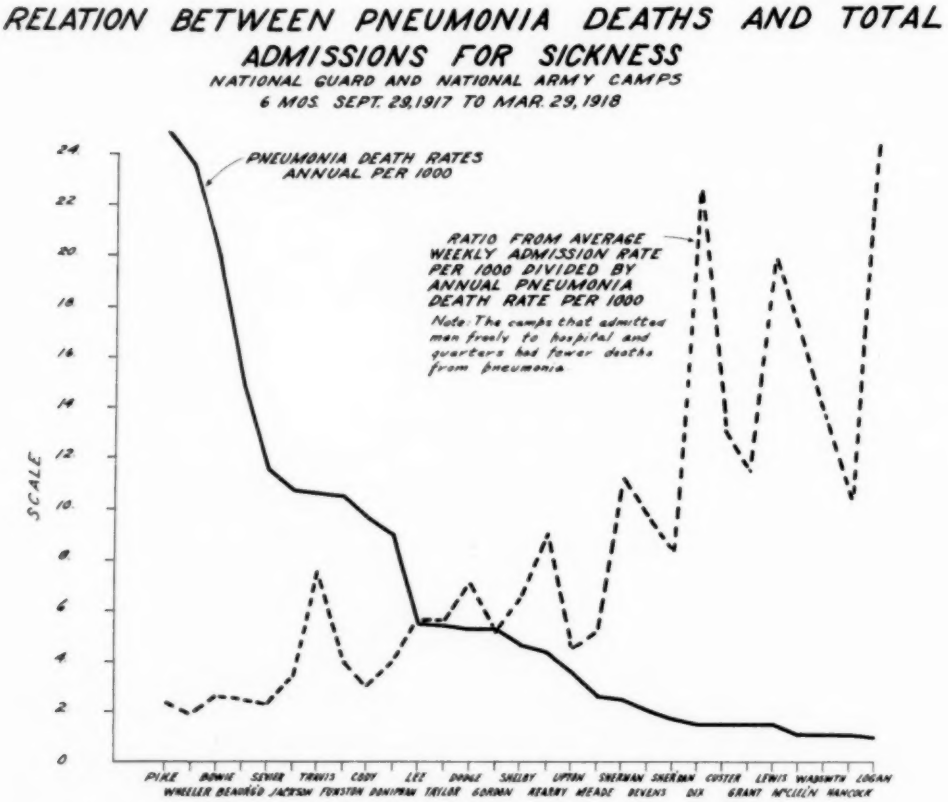

RELATION BETWEEN PNEUMONIA DEATHS AND TOTAL ADMISSIONS FOR SICKNESS
NATIONAL GUARD AND NATIONAL ARMY CAMPS
6 MOS. SEPT. 29, 1917 TO MAR. 29, 1918
PNEUMONIA DEATH RATES ANNUAL PER 1000
RATIO FROM AVERAGE WEEKLY ADMISSION RATE PER 1000 DIVIDED BY ANNUAL PNEUMONIA DEATH RATE PER 1000
Note: The camps that admitted men freely to hospital and quarters had fewer deaths from pneumonia.
SCALE
24
22
20
18
16
14
12
10
8
6
4
2
0
PIKE BOWIE SEVIER TRAVIS CODY LEE DODGE SHELBY UPTON SHERMAN SHERMAN CUSTER LEWIS WADSWTH LOGAN
WHEELER BEAUREGD JACKSON FUNSTON DONIPHAN TAYLOR GORDON KEARNY MEADE DEVENS DIX GRANT MCCLELLN HANCOCK

Chart XVI.

3. NATURAL SUSCEPTIBILITY TO DISEASE

Having considered the effect of camp life in weakening the physical tone of the soldier and the extent to which infectious disease has been spread, we come to a consideration of the innate susceptibility of the soldier or his natural immunity to disease.

If this factor is a predominating one we should expect those men who are exposed to the same general climatic influences to show similar characteristics. Or we should expect like tendencies to be exhibited by men from the same section of the country. Still further we might look for differences between city men and country men.

(a) *Racial Influence.*—The high incidence of disease at southern camps such

as Pike, Wheeler, Beauregard, Jackson, Bowie and Travis suggests that the number of negro troops there may have something to do with it, for statistics in civil life show the negro to be much more susceptible to such diseases as tuberculosis and pneumonia.

Reports from Wheeler and Beauregard show that they had no negro troops during the six months covered by this study. At Travis the proportion of white to colored troops was seven to one and the sick rates were no greater in the latter than among the former. About 25 per cent of the troops at Pike were colored. The sick rates among colored troops here was greater than among whites. We have no data as to the proportion of colored troops at Jackson, but we believe it was very small indeed if in fact there were any. With northern bred negroes at Logan there was but little difference in the sick rate between the races. With southern bred negroes in northern camps both the morbidity and mortality rates were much higher among the negroes.

There is no ground for attributing the excessive sick rates at the southern camps to colored troops.

(b) *Effect of Urban Life.*—It is a well recognized fact that respiratory disease is more common in centers of population where its means of transmission is so much readier than among the rural population. The table below well illustrates this fact and these data are typical.

TABLE 27

URBAN AND RURAL DEATH RATES, ANNUAL RATE PER 100,000
1915

	MEASLES	SCARLET FEVER	DIPHTHERIA AND CROUP	PNEUMONIA	TUBERCULOSIS OF THE LUNGS
Cities in Registration States	7.1	4.0	17.5	156	134
Rural part of Registration States	3.4	3.1	12.9	106	112

Analyzing the situation in the army with this question of population in mind we are brought face to face with some very interesting facts. These are illustrated in Chart XVII. Here we have compared the death rates among the soldiers from different sections of the country with the percentage rural population of that section. The association of high disease incidence and rural population is very suggestive.

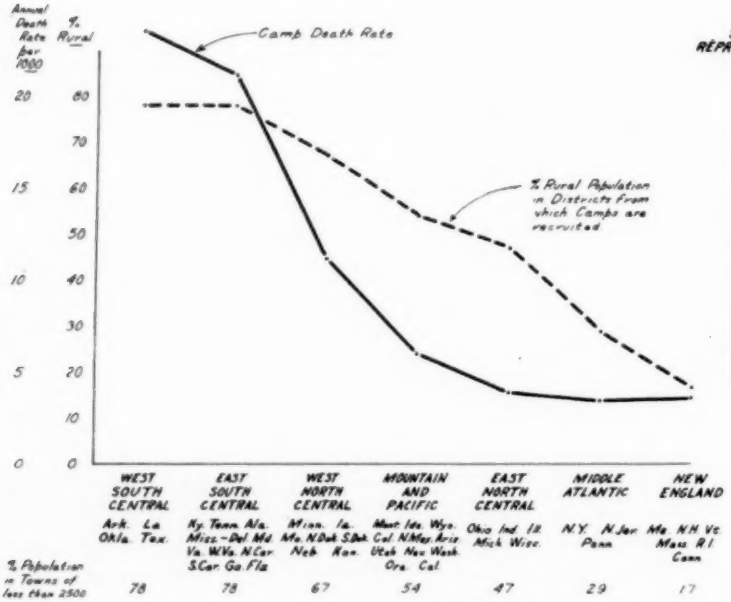
The death rates are distributed roughly in three groups. Those representing the West South Central section, the East South Central Section, and the South Atlantic stand first with the highest rates. Next with a rate just half that of the former group comes the West North Central. Next come the other sections, the difference between them being slight. New England is the least rural and has next to the lowest death rate. New England is represented by Camp Devens which contains draft men. If New England were represented in this table by a larger proportion of city men as are the other sections with their National Guard units, it is very possible that New England's death rate would be lower than it is.

The similarity in these two curves is believed to be of the greatest sig-

nificance. It will be noticed that they are not parallel throughout. There are several explanations for this. In the first place, the exactness of the two sets of data is not sufficient for a complete correlation, secondly it is felt that the disparity in the curves carries some significance. It means that factors other than sparseness of population are at work in the first two sections causing them to run unduly high. The first two sections which are more than twice the rate of the third are the only ones including southern territory. There is thus brought to light a secondary broad general influence which distinguishes different sections of the country.—This is climate. It seems reasonable to explain the high position of the first two points then as due (1) to rural population and (2) to climate. This latter influence we shall discuss in a later paragraph.

The influence of rural life on disease incidence as brought out in this table

RELATION BETWEEN RURAL LIFE AND DEATH RATES AT NATIONAL GUARD AND NATIONAL ARMY CAMPS



SECTIONS OF COUNTRY REPRESENTED IN FOLLOWING CAMPS

SECTION	CAMP	DEATH RATE	
W.S.C.	Pike	307	
	Beauregard	254	236
	Bowie	231	
	Travis	153	
E.S.C. and S.A.	Wheeler	283	
	Jackson	199	212
	Sevier	155	
W.N.C.	Cody	127	
	Dodge	119	112
	Dodge	91	
Mt. and Pac.	Kearny	81	61
	Lewis	41	
E.N.C.	Sherman	54	
	Custer	51	
	Grant	38	39
	Sheridan	28	
	Logan	23	
M.A.	Upton	53	
	Hancock	26	35
	Wadsworth	25	
N.E.	Devens	37	

NOTE
Death rate is Annual per 1000 for 6 mos. period from Sept 29, 1917 to Mar 29, 1918

Chart XVII.

is further supported by the figures gathered from the city and rural units in the camp. Camp Cody reports that disease incidence was 48 per cent higher in the 134th Infantry than in the 133rd. The latter is made up of troops from the larger cities of Iowa. The former included troops mainly from the smaller towns of Nebraska.

Similarly disease incidence was 51 per cent greater in the 136th Infantry made up from the smaller towns of Minnesota than in the 135th Infantry made up of men from the larger cities of this state.

The excess among rural troops of such diseases as measles, mumps and scarlet fever has been observed at Camp Custer and at Camp Wheeler.

Camp Wadsworth reports that their division made up of Guardsmen from the larger cities of New York State was practically free from disease until

March when about 1500 draft men from the mountains of Tennessee and Kentucky were received. Their arrival had a marked effect upon the disease rate. These men soon developed meningitis, pneumonia and the minor communicable diseases. Their noneffective rate was three times that of the original division.

The epidemiologist at Camp Doniphan points out the unusually low disease incidence among city troops as compared with those from the country. The 138th Infantry and 128th Machine Gun Battalion were recruited from St. Louis, Missouri. Their annual pneumonia morbidity rates from October to March were 15. and 25. respectively. The 137th Infantry and 129th Field Artillery were from the small towns of Kansas. Their corresponding rates were 65. and 50. respectively.

(c) *Climatic Influence.*—A climatic influence on disease incidence independent of the rural influence has already been mentioned. The relative weights of each is difficult to measure, but that they have an independent existence is quite evident. The most striking illustration of this is offered by the two maps on which are located the death rates from all causes for each camp, Charts XVIII and XIX. In the first map the circles are located at the site of the camp. It will be observed that the south is covered by circles of all shades. Logan in Texas has a death rate less than 8.0 per 1000. Travis has a rate somewhat higher. Funston represents the third group of death rates ranging from 16.0 to 24.0. The highest rate shown by the black circle is represented by Pike and Beauregard. All five of these camps are subject to approximately the same climatic influence and yet their death rates are stikingly different. Looking now at the second map we see an entirely different story. In this case the circles are located in the center of the region from which the troops are recruited. The clear circles, with a single exception, have now disappeared from the south and we find all but two located in the northern states east of the Mississippi, and this section contains none but clear circles.

The exceptions are Lewis in the northwest and Gordon in the south. Gordon would seem to controvert the evidence we have presented on this score and a great deal of speculation was raised as to why Gordon alone should exhibit characteristics different from that shown by all other southern troops. Some time elapsed before an explanation was forthcoming. Gordon, it seems, was originally set apart for troops from Georgia, Alabama, and Tennessee. About six weeks after the camp opened the above named troops were transferred to Camp Wheeler and their place was filled by men from 21 different states, largely drawn from the north. Gordon, thus, in having a death rate below 8.0 is simply exhibiting a characteristic common to the northeastern section of the country.

Evidence showing the greater susceptibility of southern troops and certain lights on the causes is to be had from the reports of the medical officers attached to these camps.

Camp Sevier.—"From 25 to 33 per cent of all cases submitted to the Base Hospital came from the mountains of East Tennessee and the Carolinas. Almost all cases of bronchopneumonia were from men of this locality. A large percentage of the men from South Carolina were suffering from hookworm infection. The percentage runs as high as 35%."

"Tennessee, North and South Carolina have furnished the largest proportion of the troops. The troops from other states have not furnished as large a percentage of sick as the troops from the above-mentioned states, but have been the means of introducing or re-introducing some of the contagious diseases."

Camp Wadsworth—The greatest prevalence of sickness occurred among troops from

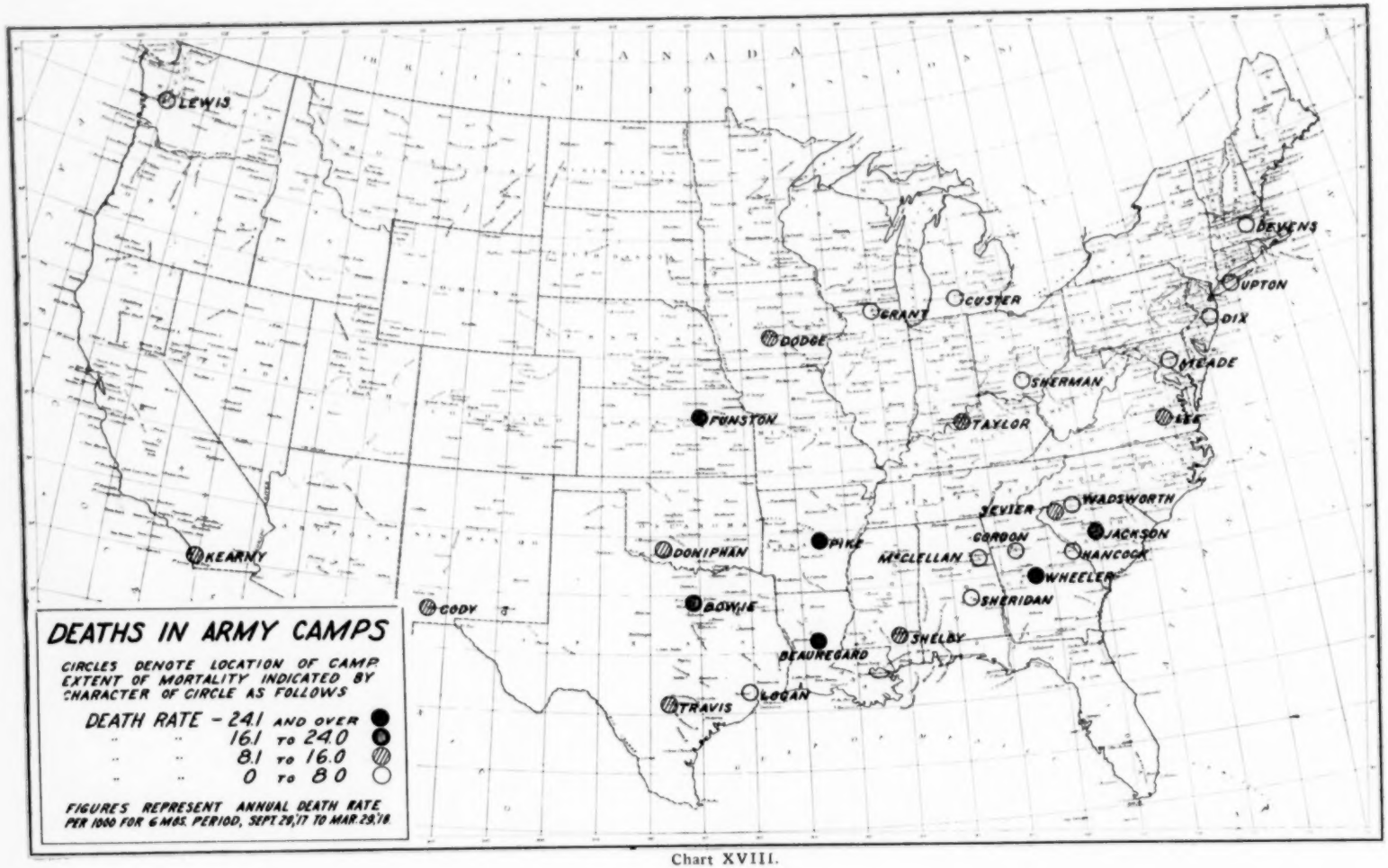

CANADA
LEWIS
KEARNY
CODY
DEWENS
UPTON
DIX
GRANT
CUSTER
DODGE
MEADE
SHERMAN
FUNSTON
TAYLOR
LEE
WADSWORTH
SEVIER
JACKSON
GORDON
PIKE
DONIPHAN
McCLELLAN
HANCOCK
WHEELER
SHERIDAN
BOWIE
SHELBY
BEAUREGARD
TRAVIS
LOGAN
DEATHS IN ARMY CAMPS
CIRCLES DENOTE LOCATION OF CAMP. EXTENT OF MORTALITY INDICATED BY CHARACTER OF CIRCLE AS FOLLOWS
DEATH RATE - 24.1 AND OVER
" " 16.1 TO 24.0
" " 8.1 TO 16.0
" " 0 TO 8.0
FIGURES REPRESENT ANNUAL DEATH RATE PER 1000 FOR 6 MOS. PERIOD, SEPT 29,17 TO MAR 29,18

Chart XVIII.

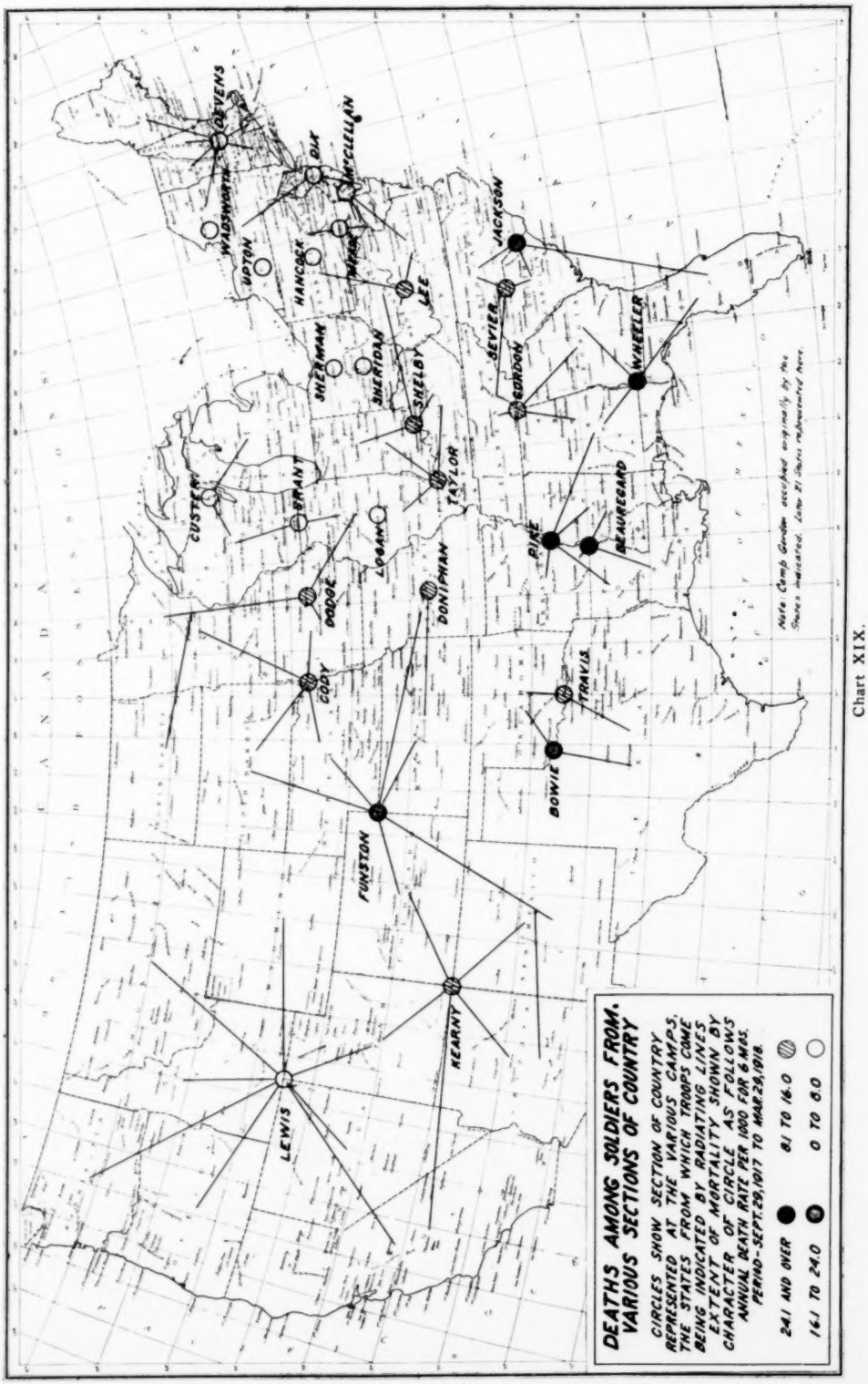

DEATHS AMONG SOLDIERS FROM VARIOUS SECTIONS OF COUNTRY
CIRCLES SHOW SECTION OF COUNTRY REPRESENTED AT THE VARIOUS CAMPS. THE STATES FROM WHICH TROOPS CAME BEING INDICATED BY RADIATING LINES EXTENT OF MORTALITY SHOWN BY CHARACTER OF CIRCLE AS FOLLOWS ANNUAL DEATH RATE PER 1000 FOR 6 MOS. PERIOD-SEPT. 29, 1917 TO MAR. 29, 1918.
24.1 AND OVER
16.1 TO 24.0
8.1 TO 16.0
0 TO 8.0
CANADA
LEWIS
FUNSTON
KEARNY
BOWIE
TRAVIS
GODY
DODGE
LOGAN
DONIPHAN
CUSTER
GRANT
TAYLOR
SHELBY
LEE
SHERIDAN
SHERMAN
HANCOCK
DIX
MCCLELLAN
WADSWORTH
UPTON
STEVENS
JACKSON
SEVIER
EDISON
WHEELER
PIKE
BEAUREGARD

Chart XIX.

Kentucky, who "brought with them measles, mumps, meningitis, pneumonia and hookworm. These were troops of low resisting powers from the mountains of Kentucky."

Camp Wheeler.—The men at Camp Wheeler were recruited mainly from Alabama, Georgia and Florida. That the location and previous environment of the troops here were responsible for the epidemic of measles and pneumonia is attested by the report of the Division Surgeon. He speaks as follows about the physical condition of the men:

"1. A class of drafted men of most miserable physique is noticed by all observers.

2. The men from the Gulf Coast could not withstand even the mild winter of Central Georgia.

3. Many of the men suffered from the anemia of hookworm or malaria."

Camp Pike—As to the fundamental causes underlying the epidemic at this camp, the following may be said:

1. "Low resistance on the part of draft troops coming from the States of Mississippi, Louisiana, Arkansas and Alabama. A study of the number of men from these sections of the country turned down by our examining board demonstrates beyond question that in the majority of instances we are dealing with a very inferior class of draft men. Company Commanders have, for example, told me of the difficulty of getting their men to eat the ordinary army food. Many of them have lived for years on corn bread and side meat."

Camp Jackson.—"The enlisted personnel of this camp seemed to show an unusual amount of illiteracy, general ignorance and ignorance of personal hygiene, all of which doubtless aided in the propagation of contagious disease. An illuminating example of the state of sophistication is the fact that classes were formed and instruction given in the use of water closets and toilet paper. The enlisted personnel comes mainly from North and South Carolina and Florida. It is mainly rural in origin and contains a relatively large proportion of men who have not had measles or mumps in childhood."

"The physical condition of the men is not more than average, and I feel sure that there must be something in the old theory of lowered resistance and other conditions having an influence on infection. About 30 per cent of the men are found to have hookworm, while about 3 per cent are suspected of having malaria."

This evidence seems sufficient to establish the physical inferiority of the men from this region. Turning again to our morbidity and mortality statistics we find still further verification of this fact. Where there is a specific susceptibility to any disease as may readily occur in persons of apparently good physical tone, we need not be surprised at the outbreak of an epidemic of that disease but we do not look for high incidence in other diseases as well. The troops from the Southern States possess a susceptibility that is general as well as specific. They are subject not only to the ravages of pneumonia, but also to other diseases as well. Their death rate from all causes is higher and their sickness incidence is greater. This fact has already been brought out by Chart III early in this report. Here eleven indices of physical well-being have been plotted for each of the 29 National Guard and National Army camps. The camps have been graded according to their relative standing in each index and the position of the squares have been placed in order of the death rate from all causes. The significant features of this Chart is that the camps with Southern troops top the list. The blackness of the square shows that these camps are not only high in one cause of sickness, but are universally high in everything. Pike, for instance, has the highest (1) death rate from all causes, (2) death rate from diphtheria, (3) morbidity from measles, (4) morbidity from scarlet fever, (5) morbidity due to venereal disease.

Wheeler is highest in deaths from tuberculosis and a close second in pneumonia morbidity.

Beauregard has the highest malaria morbidity.

Bowie stands first in pneumonia morbidity; Jackson first in meningitis morbidity, Travis first in hospital admission rate.

Five camps, Pike, Wheeler, Beauregard, Bowie and Jackson, have among

them nine out of eleven first places in the various causes which make soldiers noneffective.

Another fact which has a direct bearing on this question is that not only is the general sickness greater among Southern troops, but once sick their chances of recovery are less. Thus in Table 28 are given the morbidity and mortality rates for pneumonia and meningitis for certain camps. The Southern troops are seen to average a greater case mortality in both diseases. The Pike group have a pneumonia case mortality of 28 per cent, and a meningitis case mortality of 61 per cent. These figures are nearly twice those of the Upton group with 16 per cent and 37 per cent respectively.

TABLE 28

CASE MORTALITY FROM PNEUMONIA AND MENINGITIS IN CERTAIN CAMPS

CAMP	PNEUMONIA			MENINGITIS		
	MORBIDITY RATE	MORTALITY RATE	CASE MORTALITY %	MORBIDITY RATE	MORTALITY RATE	CASE MORTALITY %
Pike	63.	25.	40	3.8	2.4	63
Bowie	96.	20.	21	4.7	1.6	34
Beauregard	42.	15.	36	12.8	7.7	60
Wheeler	95.	24.	25	2.4	2.1	88
Jackson	36.	11.	31	25.7	7.5	29
Travis	78.	11.	14	2.7	2.5	93
Average			28			61
Upton	15.	3.6	24	.54	.34	63
Wadsworth	8.8	1.1	13	.78	.20	26
Dix	8.0	1.5	19	.57	.19	33
Logan	16.	1.0	6	.73	.22	30
Hancock	6.7	1.1	16	1.8	.44	24
Devens	9.8	2.0	20	.63	.28	44
Average			16			37

SUMMARY OF THE CAUSES OF RESPIRATORY DISEASES IN ARMY CAMPS

From this extended review of the situation we feel that the greatest single factor in the prevalence of disease in certain camps and their absence in others has been the natural susceptibility of the men. Disease incidence has been markedly greater among Southern troops. Southern troops are as a class more susceptible to respiratory disease. They are more susceptible because they have not had these diseases in childhood and therefore have established no immunity to them. They are more susceptible also because they have weaker physiques to begin with. This physical inferiority is due to ignorance of and consequent failure to act upon the fundamental laws of sanitation. In consequence those debilitating diseases such as hookworm, malaria and pellagra prevail. Venereal disease is excessive. Insufficient attention is paid to the character and quality of food consumed: these men have not learned that diseases are transmitted by germs most of which gain access to the body through the mouth and nose. Spitting is promiscuous. There is no thought of stopping it even in tents and barracks. The reason for stopping it is not even appreciated.

With this condition of affairs to start with we find that there have been added those aggravating factors such as exposure, fatigue, lack of warm clothing, cold quarters by day, cold quarters and insufficient bedding by night. These

men were naturally susceptible. Lessen their resistance still further, introduce the carrier case and it is not at all difficult to anticipate the result. The fire rages among this highly inflammable timber.

The value and purpose of an epidemiological study is to discover facts that will prevent a recurrence of the trouble. Now that we have established the case how are we to act upon it?

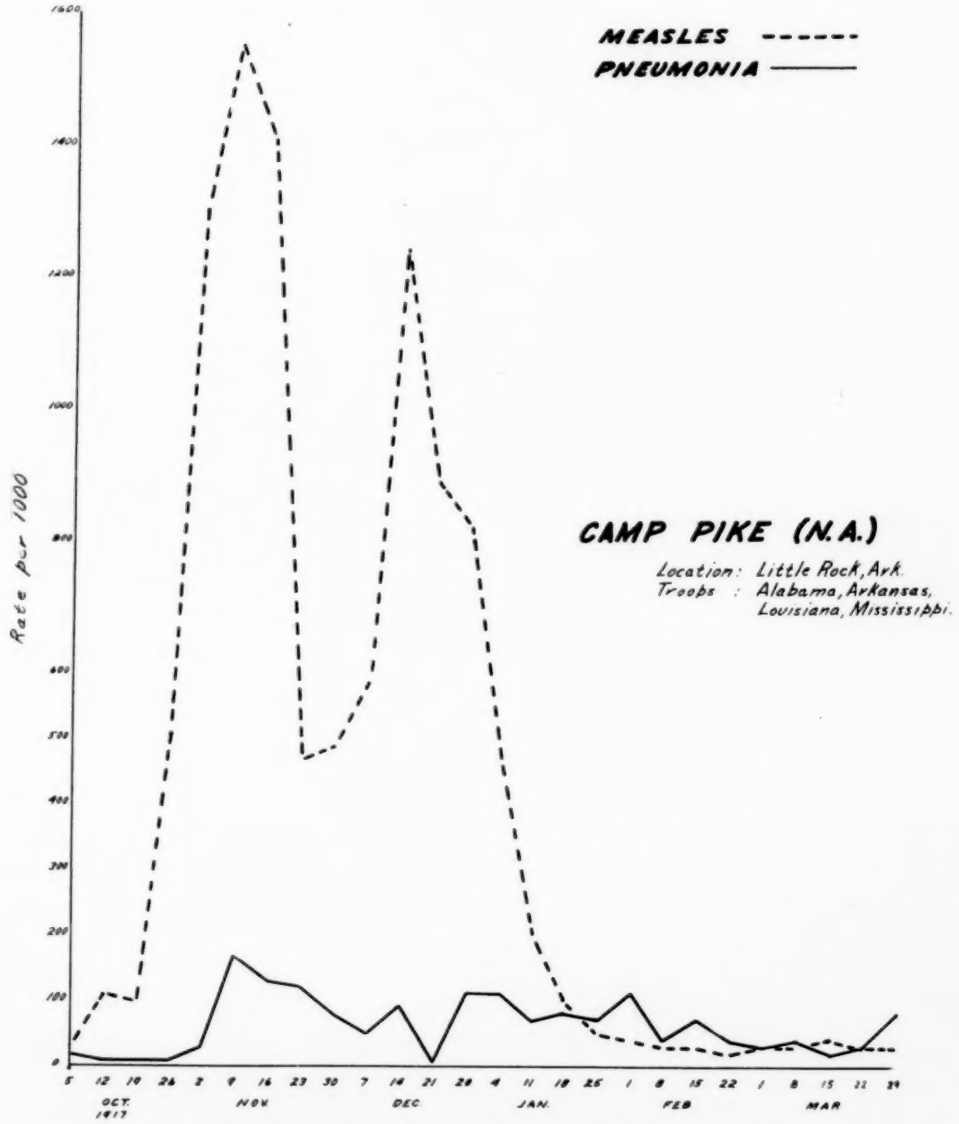
First and foremost it seems necessary to graduate the introduction of civilians into army life. The change has been too abrupt. Men should be called first to a semiactive reserve army. Here they should get drill and the essentials of sanitation and self care by lecture and by demonstration. The drill and calisthenics should be the hardening process. After this the transfer should be made to camp where a man's entire time is given over to his military training.

Before entering camp men should be examined for incipient disease. The suspects should be separated and watched before their dispatch to camp. Vaccination for typhoid and smallpox can be completed while in the reserve force.

Once established in camp the transfer of men from one camp to another should not take place without a careful examination and removal of those who show signs of illness. This will prevent this all too frequent transportation of sick men, who are dangerous to others because of their sickness.

These precautions together with care in the proper mixture of work and rest, judicial selection in the quality and balancing of the food ration, the adequate protection of the man, especially the one from the warm climate, against cold and exposure, his protection against the sick through effective quarantine measures, and discretion in the use of the physical hardening process should moderate to a large degree the experiences of the past winter.

RESPIRATORY DISEASE AT ARMY CAMPS



Annual Morbidity Rate per 1000 for Week –

Chart XX.

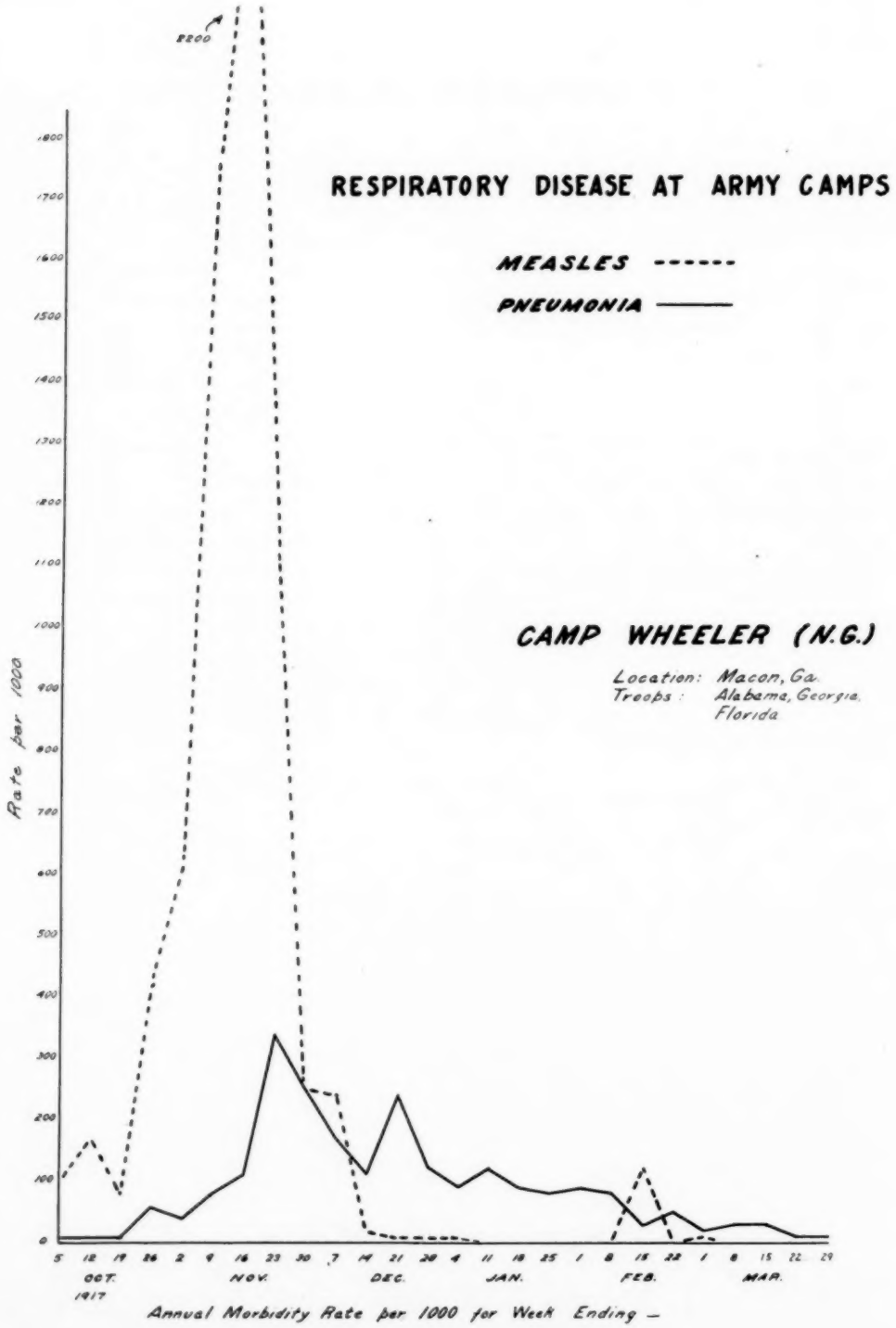

RESPIRATORY DISEASE AT ARMY CAMPS
MEASLES ------
PNEUMONIA ——
CAMP WHEELER (N.G.)
Location: Macon, Ga.
Troops: Alabama, Georgia, Florida
Rate per 1000
2200
1800
1700
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
5 12 19 26 2 9 16 23 30 7 14 21 28 4 11 18 25 1 8 15 22 1 8 15 22 29
OCT. 1917
NOV.
DEC.
JAN.
FEB.
MAR.
Annual Morbidity Rate per 1000 for Week Ending —

Chart XXI.

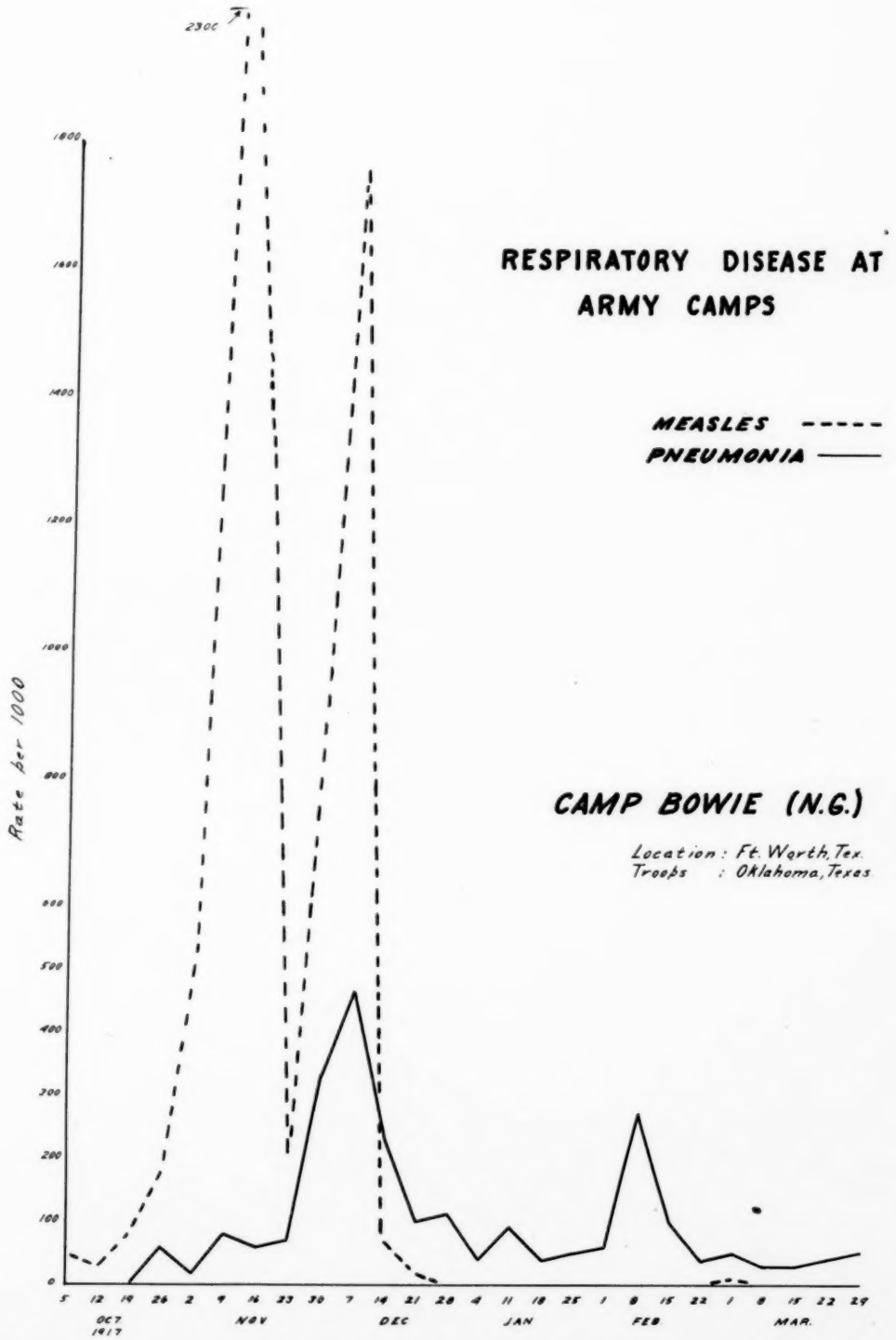
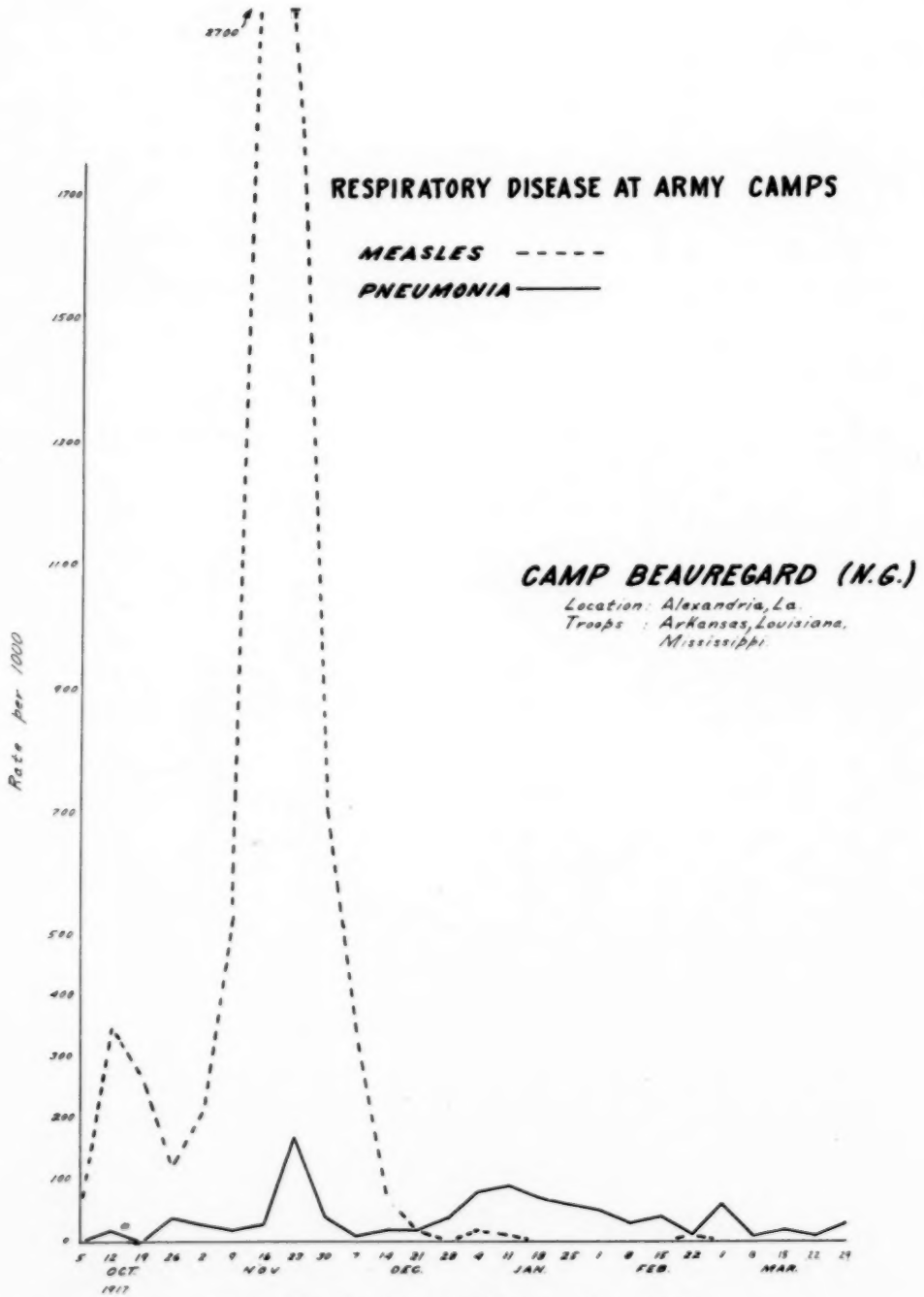

2300
1800
1600
1400
1200
1000
800
600
500
400
300
200
100
0
Rate per 1000
RESPIRATORY DISEASE AT ARMY CAMPS
MEASLES -----
PNEUMONIA ——
CAMP BOWIE (N.C.)
Location : Ft. Worth, Tex.
Troops : Oklahoma, Texas
5 12 19 26 2 9 16 23 30 7 14 21 28 4 11 18 25 1 8 15 22 1 8 15 22 29
OCT. 1917
NOV
DEC
JAN
FEB
MAR.
Annual Morbidity Rate per 1000 for Week Ending –

Chart XXII.



Annual Morbidity Rate per 1000 for Week Ending —

Chart XXIII.

RESPIRATORY DISEASE AT ARMY CAMPS

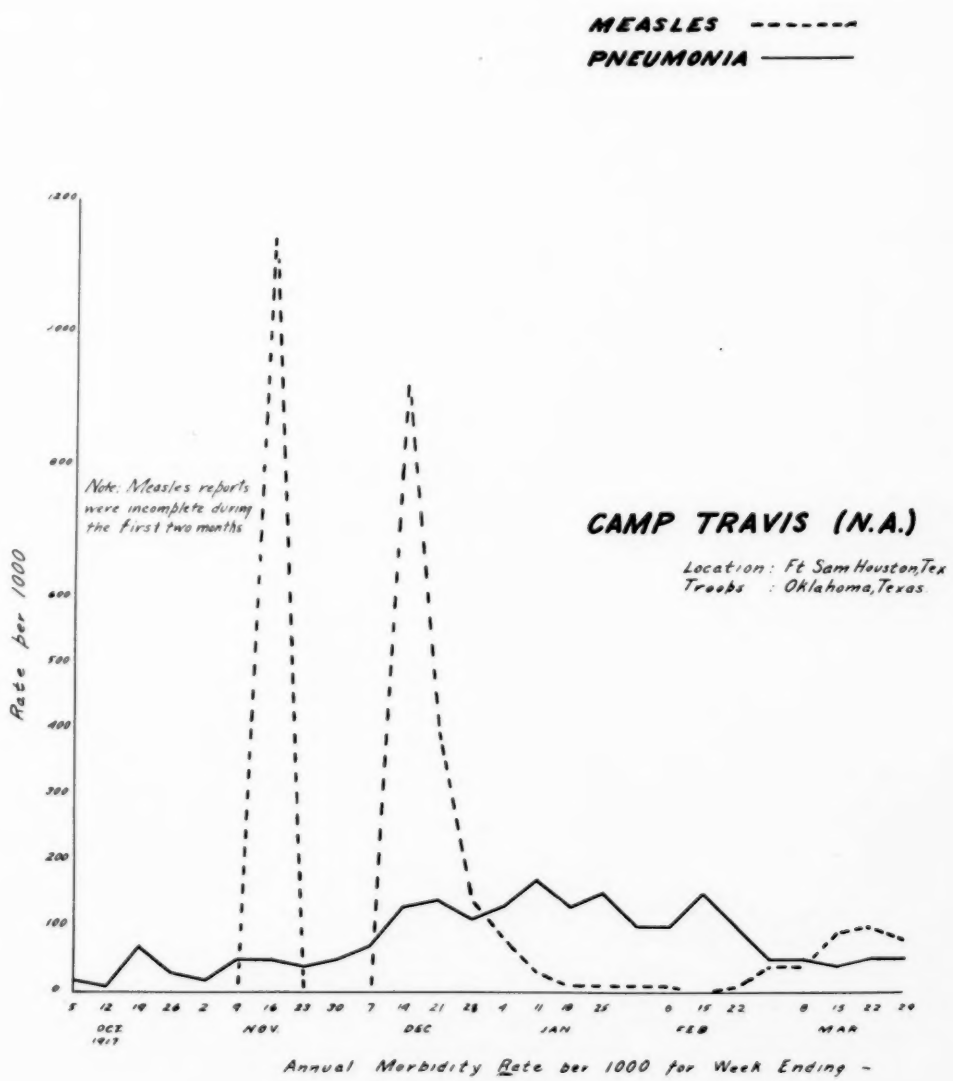


Chart XXIV.

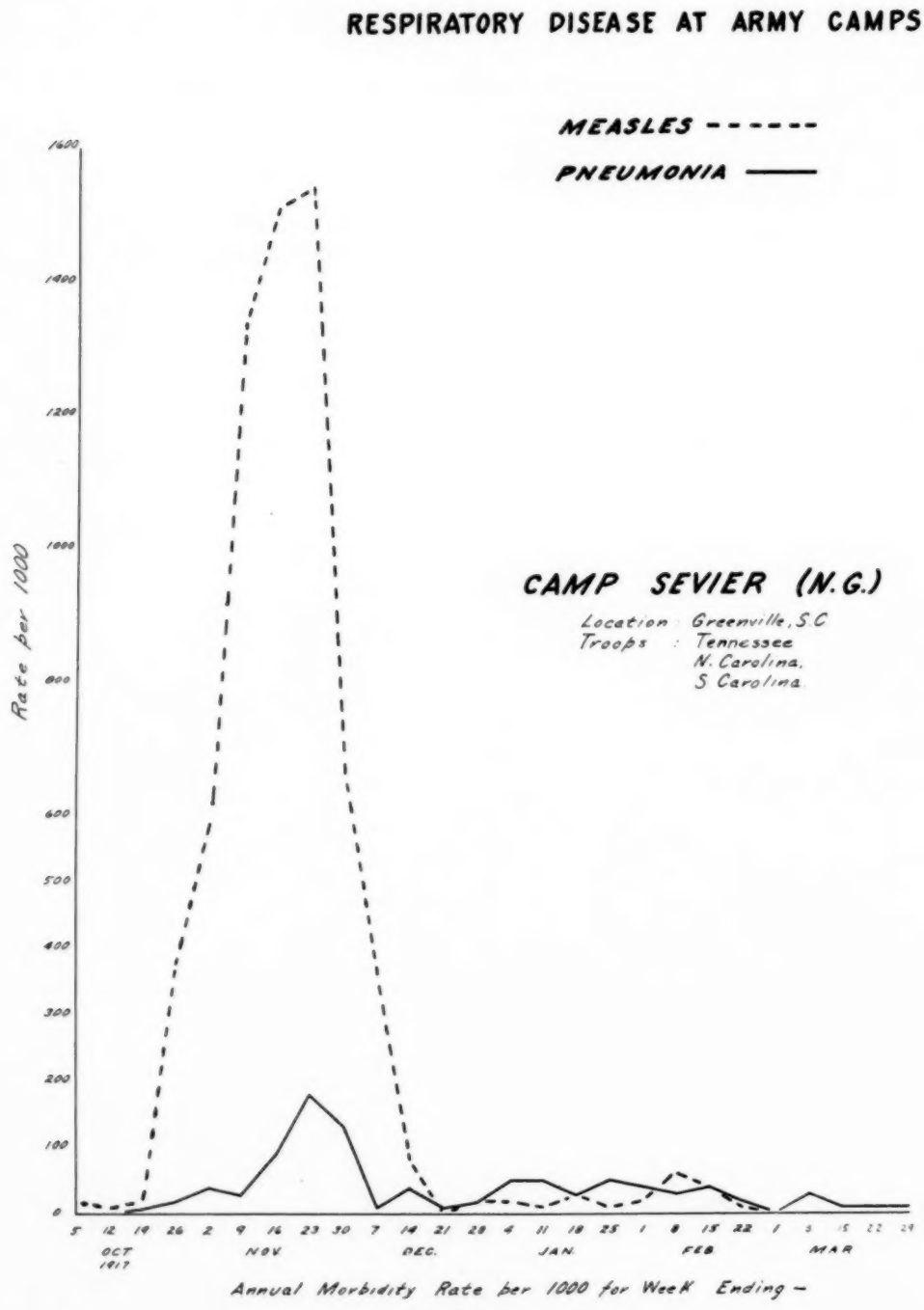

RESPIRATORY DISEASE AT ARMY CAMPS
MEASLES ------
PNEUMONIA ——
CAMP SEVIER (N.G.)
Location : Greenville, S.C.
Troops : Tennessee
N. Carolina,
S. Carolina
Rate per 1000
1600
1400
1200
1000
800
600
500
400
300
200
100
0
5 12 19 26 2 9 16 23 30 7 14 21 28 4 11 18 25 1 8 15 22 1 8 15 22 29
OCT 1917
NOV
DEC.
JAN.
FEB
MAR
Annual Morbidity Rate per 1000 for Week Ending –

Chart XXV.

RESPIRATORY DISEASE AT ARMY CAMPS

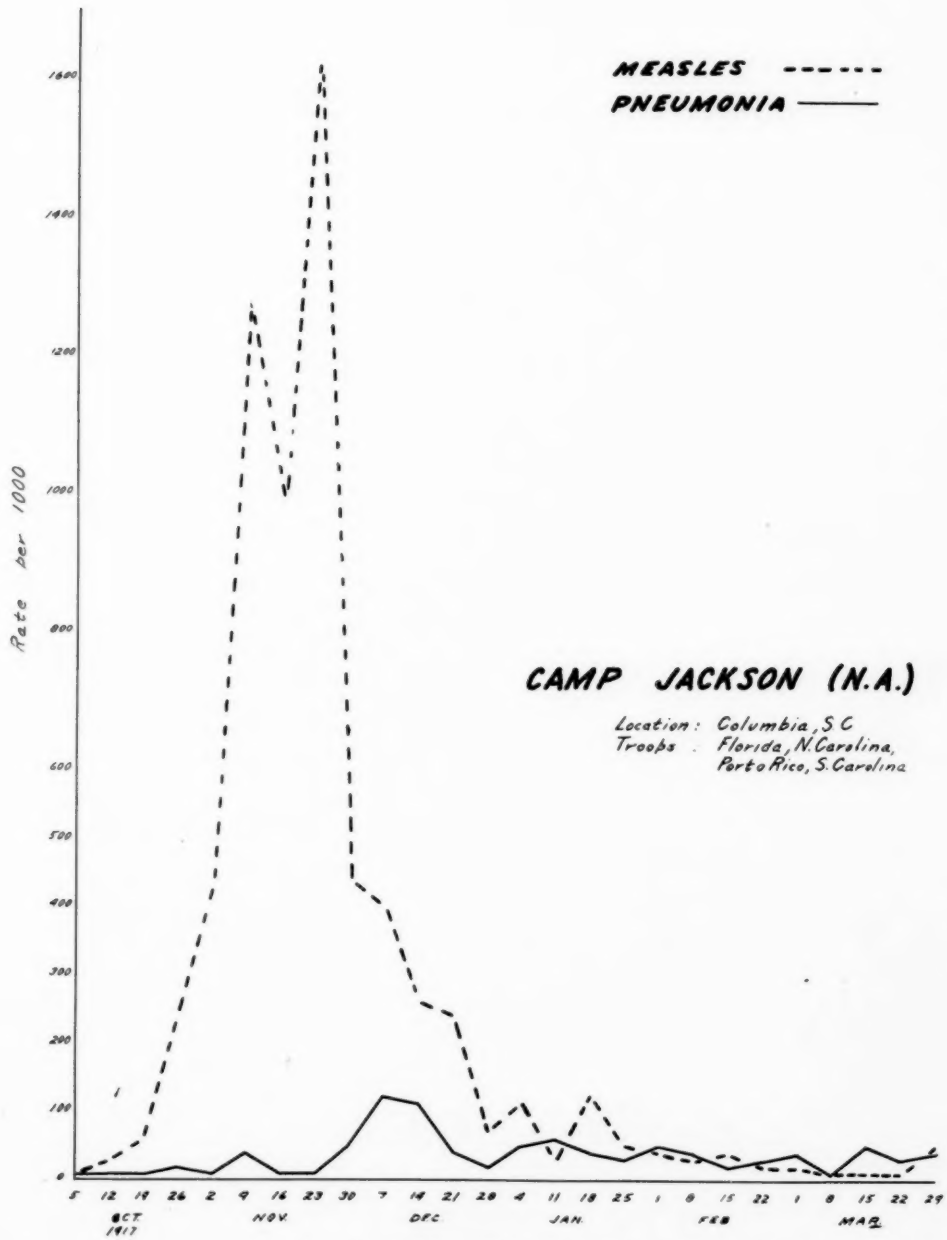


Chart XXVI.

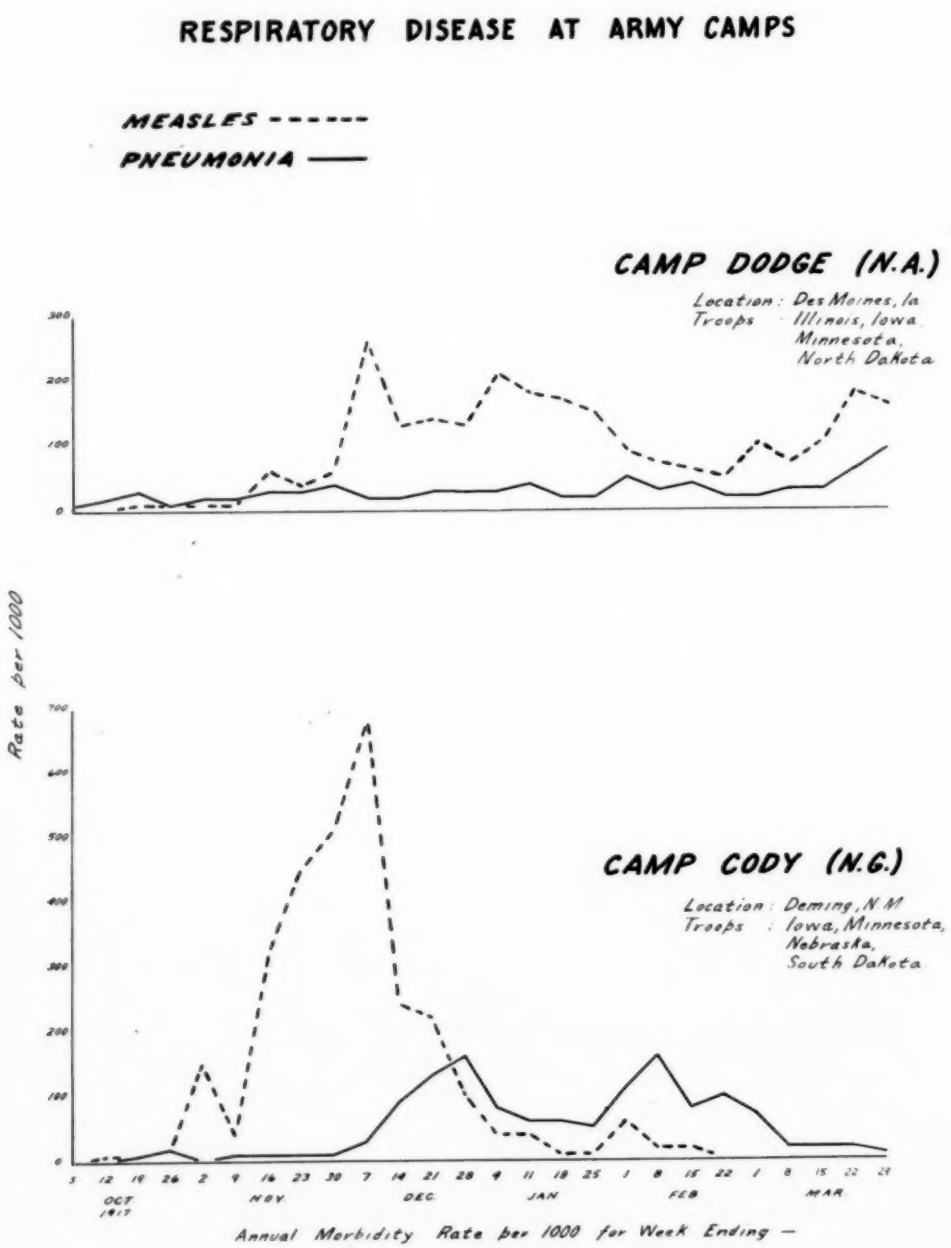

RESPIRATORY DISEASE AT ARMY CAMPS
MEASLES ------
PNEUMONIA ——
CAMP DODGE (N.A.)
Location: Des Moines, Ia
Troops: Illinois, Iowa, Minnesota, North Dakota
300
200
100
0
Rate per 1000
700
600
500
400
300
200
100
0
CAMP CODY (N.C.)
Location: Deming, N.M.
Troops: Iowa, Minnesota, Nebraska, South Dakota
5 12 19 26 2 9 16 23 30 7 14 21 28 4 11 18 25 1 8 15 22 1 8 15 22 29
OCT 1917
NOV.
DEC.
JAN
FEB
MAR
Annual Morbidity Rate per 1000 for Week Ending —

Chart XXVII.

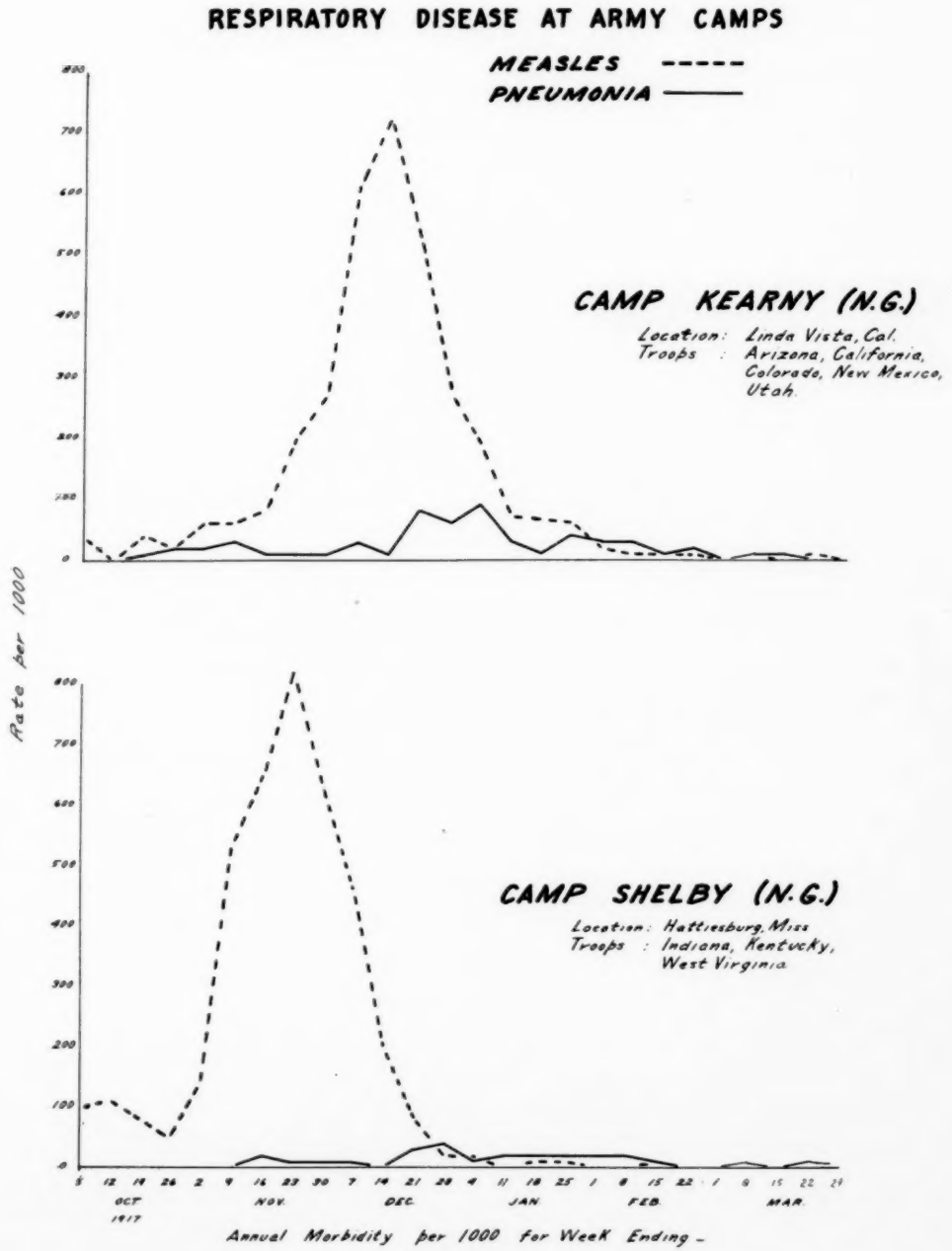
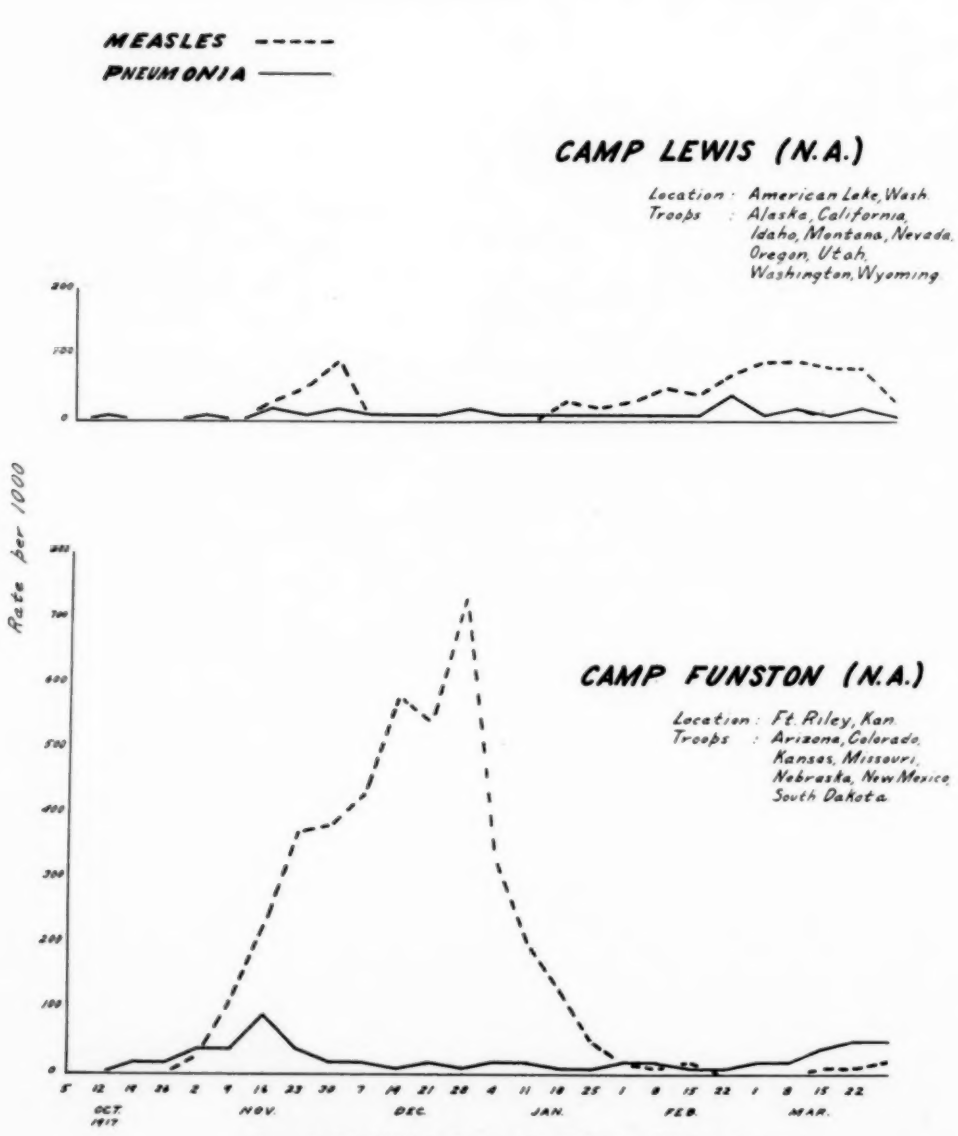

RESPIRATORY DISEASE AT ARMY CAMPS
MEASLES -----
PNEUMONIA ———
CAMP KEARNY (N.G.)
Location: Linda Vista, Cal.
Troops : Arizona, California, Colorado, New Mexico, Utah.
CAMP SHELBY (N.G.)
Location: Hattiesburg, Miss
Troops : Indiana, Kentucky, West Virginia.
Rate per 1000
0 100 200 300 400 500 600 700 800
5 12 19 26 2 9 16 23 30 7 14 21 28 4 11 18 25 1 8 15 22 1 8 15 22 29
OCT. 1917
NOV.
DEC.
JAN
FEB.
MAR.
Annual Morbidity per 1000 for Week Ending -

Chart XXVIII.

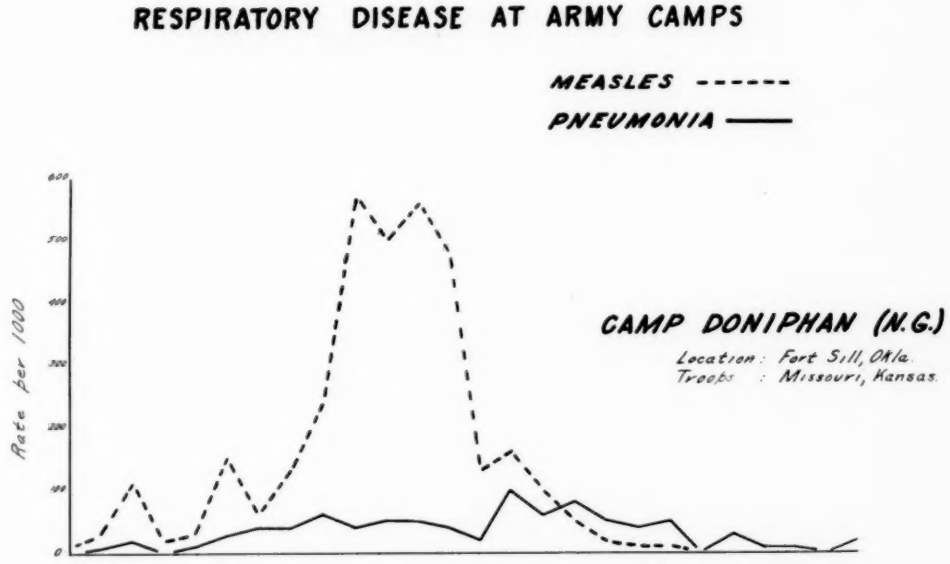
RESPIRATORY DISEASE AT ARMY CAMPS



Annual Morbidity Rate per 1000 for Week Ending —

Chart XXIX.

RESPIRATORY DISEASE AT ARMY CAMPS



Annual Morbidity Rate per 1000 for Week Ending —

Chart XXX.

RESPIRATORY DISEASE AT ARMY CAMPS

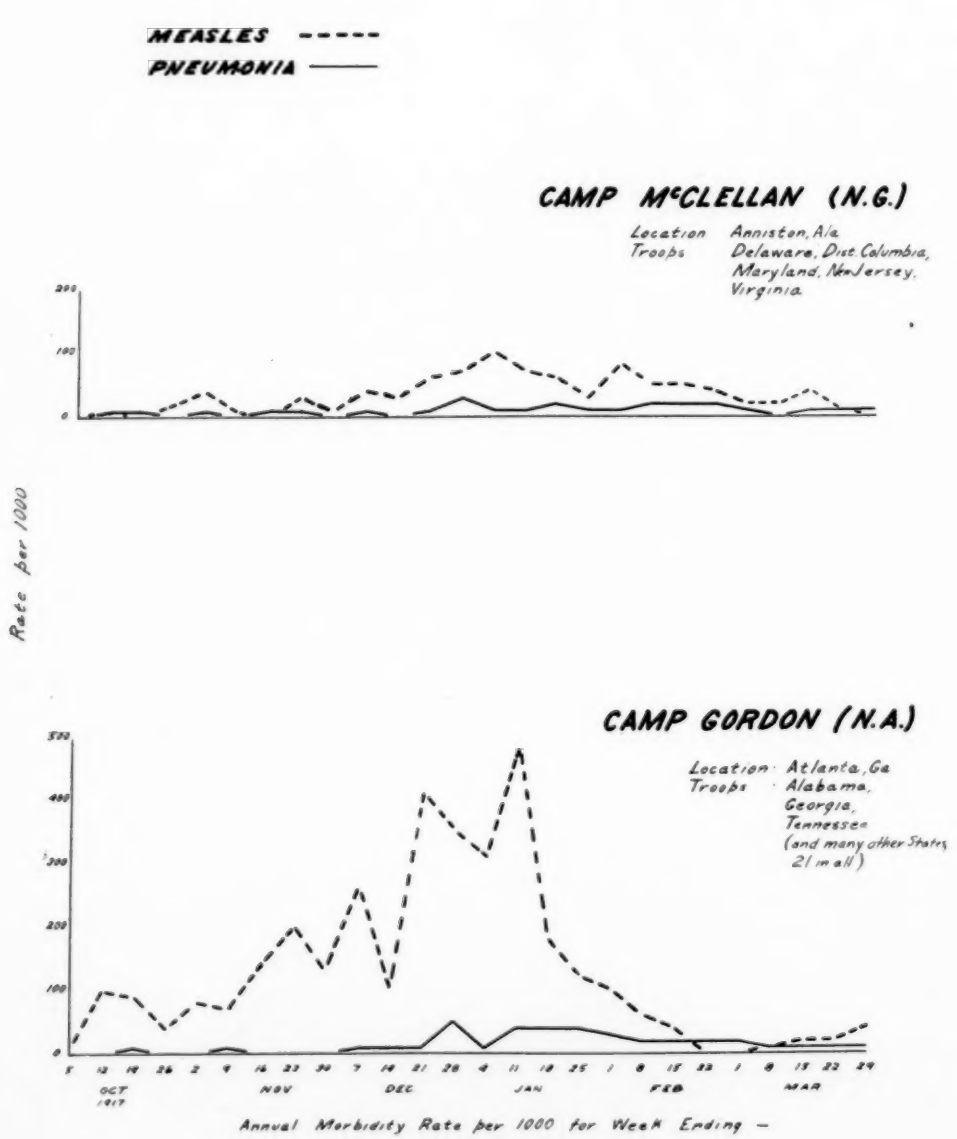


Chart XXXI.

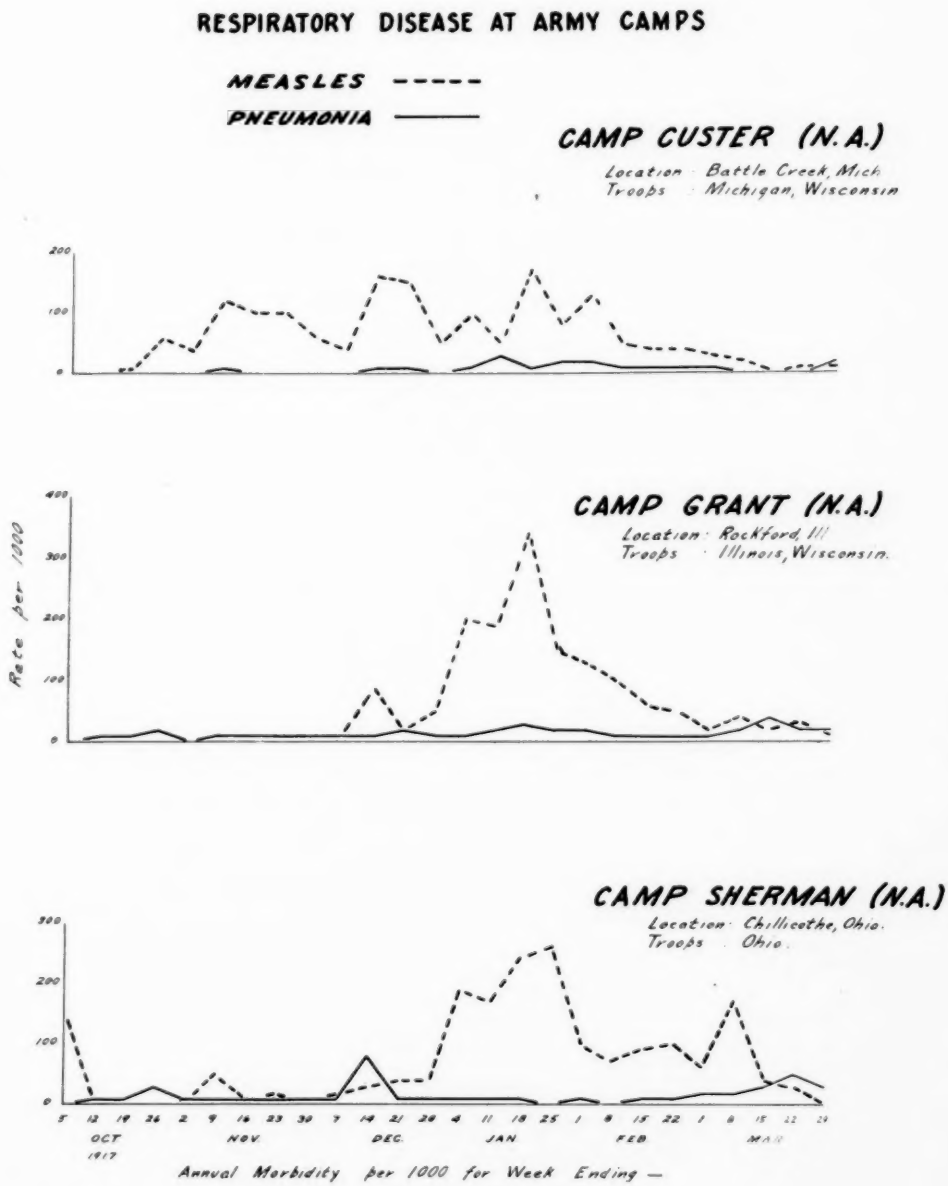
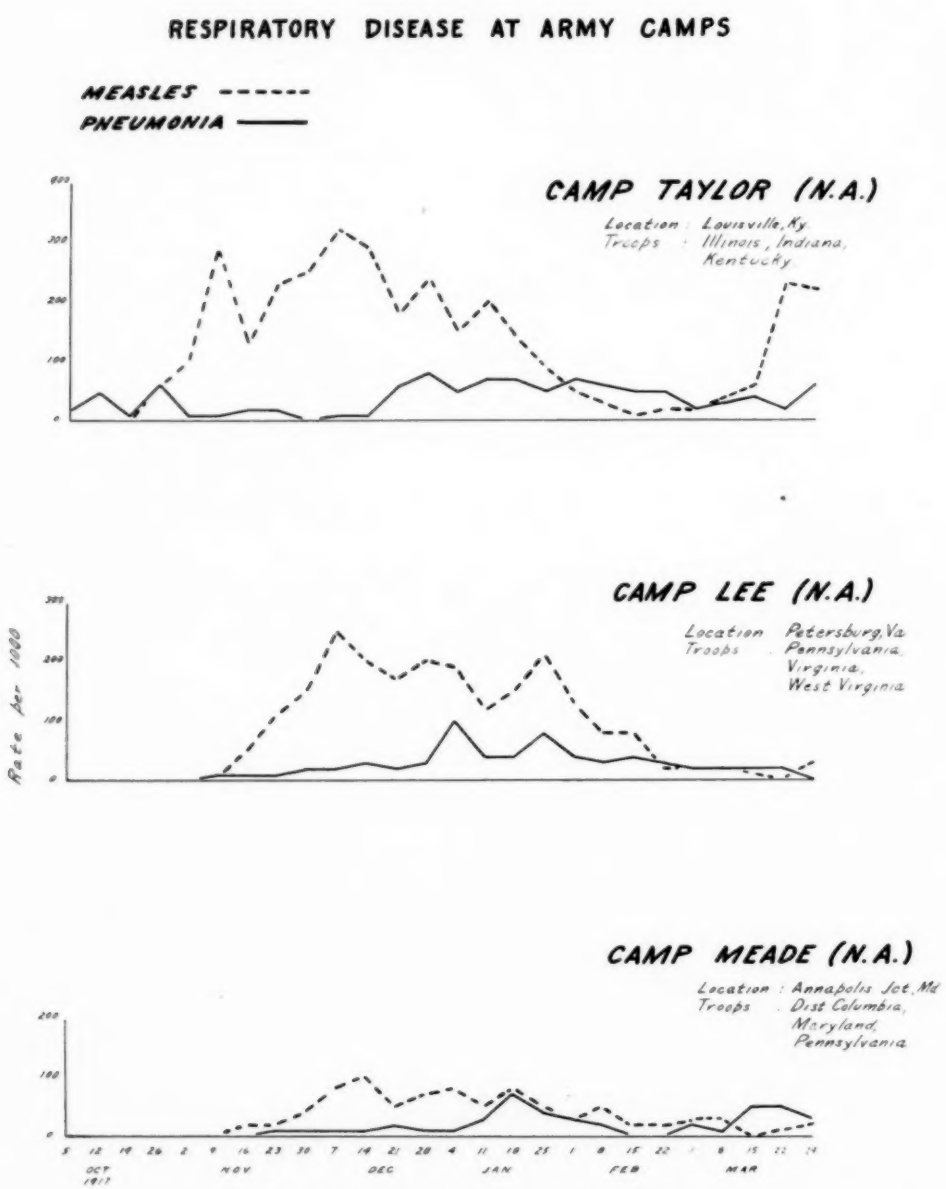

RESPIRATORY DISEASE AT ARMY CAMPS
MEASLES -----
PNEUMONIA ———
CAMP CUSTER (N.A.)
Location: Battle Creek, Mich.
Troops: Michigan, Wisconsin
200
100
0
CAMP GRANT (N.A.)
Location: Rockford, Ill.
Troops: Illinois, Wisconsin.
Rate per 1000
400
300
200
100
0
CAMP SHERMAN (N.A.)
Location: Chillicothe, Ohio.
Troops: Ohio.
300
200
100
0
5 12 19 26 2 9 16 23 30 7 14 21 28 4 11 18 25 1 8 15 22 1 8 15 22 29
OCT 1917
NOV.
DEC.
JAN
FEB
MAR
Annual Morbidity per 1000 for Week Ending —

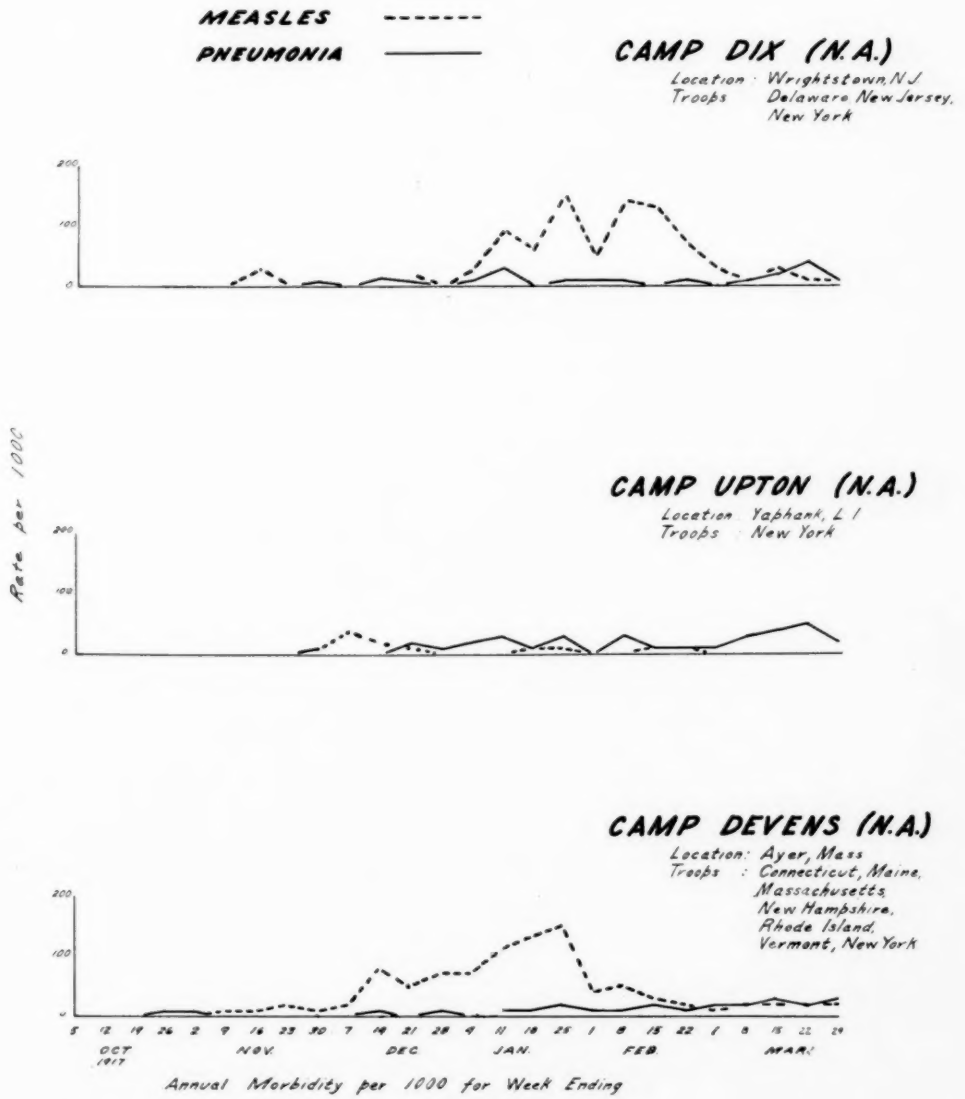
Chart XXXII.



Annual Morbidity Rate per 1000 for Week Ending —

Chart XXXIII.

RESPIRATORY DISEASE AT ARMY CAMPS



Annual Morbidity per 1000 for Week Ending

Chart XXXIV.

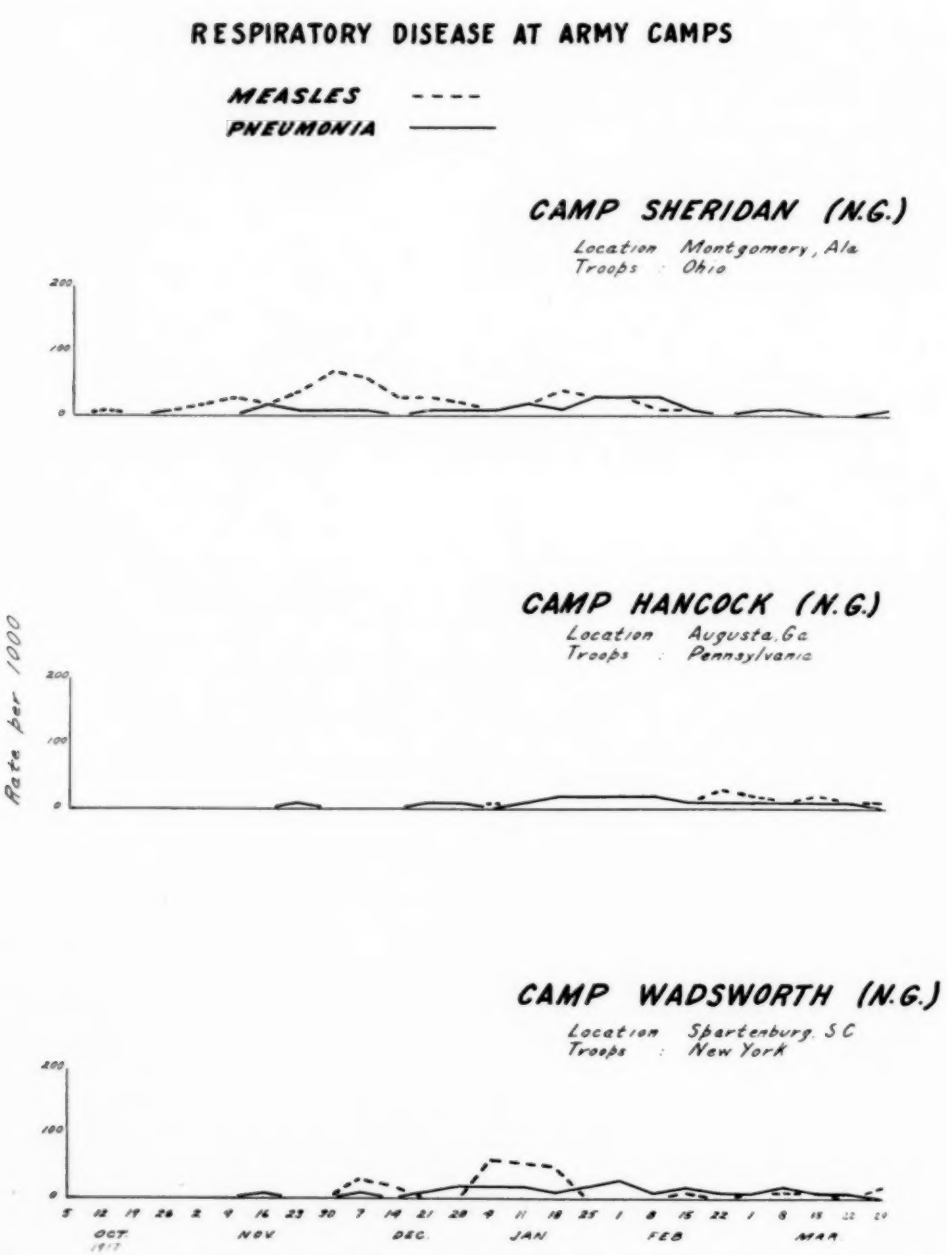

RESPIRATORY DISEASE AT ARMY CAMPS
MEASLES ----
PNEUMONIA ——
CAMP SHERIDAN (N.G.)
Location Montgomery, Ala
Troops : Ohio
200
100
0
CAMP HANCOCK (N.G.)
Location Augusta, Ga
Troops : Pennsylvania
Rate per 1000
200
100
0
CAMP WADSWORTH (N.G.)
Location Spartenburg, S.C
Troops : New York
200
100
0
5 12 19 26 2 9 16 23 30 7 14 21 28 4 11 18 25 1 8 15 22 1 8 15 22 29
OCT. 1917
NOV
DEC.
JAN
FEB
MAR
Annual Morbidity Rate per 1000 for Week Ending —

Chart XXXV.

TABLE OF CONTENTS

The Communicable Diseases in the National Guard and National Army of the United States during the Six Months from September 28, 1917, to March 29, 1918.

	Page
Preface	635
Introduction	635
Comparative Mortality in Army and Civil Life	636
Comparative Death Rates in National Guard and National Army	664
Causes of Death in the Army	645
Sickness in the Army	648
Epidemic Disease in National Guard and National Army Camps	649
Pneumonia	649
Differences in the Virulence of the Infecting Organisms Causing Pneumonia	653
Difference in Susceptibility to Pneumonia of the Men in Different Camps and the Experiences of the Civil War in this Connection	655
Measures for Protection against Pneumonia and Other Respiratory Disease	660
Measles	662
Meningitis	666
Scarlet Fever	668
Differences in the Behavior of Measles, Pneumonia, Meningitis and Scarlet Fever	670
Typhoid and Paratyphoid	672
Diphtheria	674
Tuberculosis	674
Epidemic Bronchitis	675
Influenza	676
Analysis of Causes of Disease in the Army	679
1. Influence of these Factors which bring on Physical Debility	681
a. Exposure to severe weather	681
b. Insufficient clothing	683
c. Inadequate housing—lack of heat	684
d. Fatigue	684
2. Unusual Facilities for the Transmission of the Infective Agent	685
a. Close Contact with Carrier Cases	685
b. Undetected Cases among New Recruits	687
c. Importation of Mildly Sick Men from Other Camps	687
d. Association with Civilian Community	688
e. Overcrowded Quarters	689
f. Inadequate Hospital Care of Patients	690
g. Unsanitary Conditions in General	691
3. Natural Susceptibility to Disease	692
a. Racial Influence	692
b. Effect of Urban Life	693
c. Climatic Influence	695
Summary of the Causes of Respiratory Diseases in Army Camps	699

LIST OF CHARTS

Chart No.	Page
I. Death Rates from all Causes in National Guard and National Army Camps	638
II. Comparative Mortality in Certain Army Camps and American Cities	640
III. Comparative Mortality and Morbidity from Various Causes in National Guard and National Army Camps	642

IV. Respiratory Disease Incidence in Civilian and Army Life 644
V. Distribution of Deaths in the Army by Cause 646
VI. Relative Frequency of the Various Causes of Admission to Hospital and Quarters 648
VII. Pneumonia in National Guard and National Army Camps 651
VIII. The Fruits of Preventive Medicine 659
IX. Measles in National Guard and National Army Camps 663
X. Meningitis in National Guard and National Army Camps 665
XI. Seasonal Occurrence of Communicable Disease in National Guard and National Army Camps 671
XII. Banishing Typhoid Fever from the American Army 673
XIII. Mean Monthly Temperature in Certain U. S. Cities 682
XIV. Venereal Disease in the Three Groups of the U. S. Army 686
XV. Pneumonia Death Rate and Sickness Admissions at Camps Bowie and Travis .. 691
XVI. Relation between Pneumonia Death Rate and Total Admissions for Sickness .. 692
XVII. Relation between Rural Life and Death Rates at National Guard and National Army Camps 694
XVIII. Map showing Death Rates in National Guard and National Army Camps 696
XIX. Map showing Death Rates among Soldiers from Various Sections of the Country 697

Weekly Incidence of Pneumonia and Measles at National Guard and National Army Camps

XX. Pike 701
XXI. Wheeler 702
XXII. Bowie 703
XXIII. Beauregard 704
XXIV. Travis 705
XXV. Sevier 706
XXVI. Jackson 707
XXVII. Dodge, Cody 708
XXVIII. Kearny, Shelby 709
XXIX. Lewis, Funston 710
XXX. Doniphan, Logan 711
XXXI. McClellan, Gordon 712
XXXII. Custer, Grant, Sherman 713
XXXIII. Taylor, Lee, Meade 714
XXXIV. Dix, Upton, Devens 715
XXXV. Sheridan, Hancock, Wadsworth 716

The Journal of Laboratory and Clinical Medicine

VOL. III. AUGUST, 1918 No. 11

Editor-in-Chief: VICTOR C. VAUGHAN, M.D.
Ann Arbor, Mich.

ASSOCIATE EDITORS

DENNIS E. JACKSON, M.D. - - ST. LOUIS
HANS ZINSSER, M.D. - - - NEW YORK
PAUL G. WOOLLEY, M.D. - - CINCINNATI
FREDERICK P. GAY, M.D. - - BERKELEY, CAL.
J. J. R. MACLEOD, M.B. - - - TORONTO
ROY G. PEARCE, M.D. - - - CLEVELAND
ROGER S. MORRIS, M.D. - - - CINCINNATI
GERALD B. WEBB, M.D. - COLORADO SPRINGS
E. E. SOUTHARD, M.D. - - - - BOSTON

Contents of this Journal Copyright, 1918, by The C. V. Mosby Company—All Rights Reserved

Entered at the Post Office at St. Louis, Mo., as Second-Class Matter

EDITORIALS

Convulsions

THERE are two factors which, together, cooperate in producing the symptom which we call a "convulsion." One of these we may call the chemical factor; the other the mechanical. The one, the chemical, acts in producing edema of the brain, which so long as there is a sufficient blood supply shows itself in headache, moderate dilatation of the pupils, and other changes which are suggestive of more serious symptoms which are convulsive depending upon the amount of blood that reaches the swollen central nervous system. The amount of blood reaching the brain depends upon the difference between the intravenous pressure and the intracerebral pressure. As long as the cerebral swelling is not great enough to bring the difference in intravenous and intracerebral pressure too close to zero a convulsion does not occur. Also as long as the intravenous pressure remains enough above the intracerebral pressure to adequately supply the brain with blood, the convulsion will not occur.

Ervin[1] has studied the relation of blood pressure to convulsions. He says, "It is well known that the blood pressure is a function of the intracranial pressure, rising directly with it. Normally the blood pressure is higher than the

[1]Ervin: Jour. Amer. Med. Assn., 1918, lxx, 1218.

intracranial pressure. The height of the blood pressure over that of the intracranial, or the difference between the two, is a margin of safety. As these two approximate each other, as the margin diminishes toward zero, or even tends to become a negative quantity (that is, when the blood pressure is less than the intracranial pressure) less blood is sent to the brain."

When this happens the brain must undergo some changes, one of which shows itself in fag of the vasomotor center. When this occurs the blood pressure which has been maintained as high as possible to counteract the high intracranial pressure, drops. The intracranial pressure now becomes greater than that of the blood, the pupils dilate, and the convulsion comes on. The muscular contractions of the muscles play a vicarious part in improving the condition by forcing blood from the periphery and increasing the amount sent to the brain. With this increased blood supply the centers take up their work again for the time being, and the convulsion passes.

Ervin shows by his observations upon his patients that a drug like nitroglycerine which will reduce the blood pressure will also tend to produce a convulsion if it is given at a time when the factor of safety is small, whereas a drug like adrenaline which will increase the blood pressure will tend to prevent or to shorten a convulsion if it is given at the appropriate time.

—P. G. W.